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COUNTRY USSR

REPORT

SUBJECT Soviet Technical Documents on the PRZS-3 Battery Charging Station, the AKZS-40 Oxygen Charging Station, the Deviation Goniometer DP, and the MA-100M and MA-250M Inverter Units

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THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE.

Soviet technical handbooks described below are in the English language and all bore the 50X1-HUM inscription Prague, 1957, on the cover; no other publishing data appeared.

a. Instruction for the Repair and Battery Charging Station PRZS-3 (Mobile Repairing and Charging Station - Handbook), 87 pages, including sections on the description and technical characteristics, general description of the mobile shop, main equipment of the workshop, special equipment, work and servicing of the workshop, use and servicing of the charging units, servicing of the chassis, and servicing of the workshop equipment. Photographs and sketches of the equipment are included in the text.

b. AKZS-40 Motorcar Oxygen Charging Station (Automobile Oxygen-Filling Station "AKZS-40": Description and Instructions for Use), 113 pages, including sections on general information, technical characteristics, description of the body of the station, the driv of the compressor, the compressor, the oxygen pipeline system and equipment, and instructions for use. Diagrams and sketches of the equipment are included in the text.

c. Deviation Goniometer DP, 11 pages, including short descriptions of the principal characteristics, the instrument, method of installation, control, determinatior

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GROUP 1
Excluded from automatic downgrading and declassification

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of the magnetic bearings and adjustment of the aircraft to the course according to border bearings, adjustment of the aircraft according to magnetic bearings, and instructions for installation and maintenance.

d. Modernized Inverter Units - Types MA-100M, MA-250M (Technical Features and Operating Instructions), 84 pages, including sections on the field of application, general characteristics, main characteristics of the units, volume of delivery, circuit connections, instructions for installation and operation, faults, their causes and remedies, and directions for packing and storing. Photographs, sketches, and diagrams of the equipment are included in the text.

DEVIATION G O N I O M E T E R - DP.

I. Determination.

The gonipmeter is an angle-gauge instrument with compass and dippters for visual observation and is designed for the determination of magnetic bearings (MP) of the objects, and also for the adjustment of the airplans to magnetic course (MK) according to magnetic bearings or according to calculated border bearings (BP) during the determination of the deviation.

The index ring, divided into 360 equal parts with the division value of 1 serves to solve the given problems.

The reading on the index ring is accomplished by means of indexes, fastened to the diopters. The division value of the level in the interval between the round marks is 7′- 15′.

The assembly of the instrument includes: the gonioeter, the clamp screw, the box and the camera-stand.

Accessories: antimagnetic screw-driver, 45 mm screw driver, reserve needles for the diopter, wiping rag and oil-can with oil. Technical documentation : description, formulary, photographs of putting into (on the cover of the box) and resistor of the assembly (on the cover of the box).

II. Principal characteristics.

Minimum division value of the index ring	1°
Reading accuracy on the indexes of the alidade and magnetic course	0,1°
Division value of the level	7′- 15′
Weight of the instrument	1,4 kg
Weight of the box with the instrument and accessories	3,2 kg
Weight of the camera-stand.	1,8 kg
Weight of the instrument in operating position (without the camera-stand)	280 mm
Length of the camera-stand (put together)	850 mm

The goniometer operates continually in the temperature from + 45°C to -45°C.

III. Description.

The principal part of the goniometer (Fig.1 and 2) is the index ring 1

with two scales - the external and the internal (on Fig.2 the scales are marked by dot and dash line), which are marked in clockwise direction at ten grades.

The external scale serves for reading on the index MK 2, and the internal serves for reading on the indexes of the alidade MP and BP 3. The cone 5, which rotates in the hub 6 and is fastened by the screw 7, is fixed by the scres 4 to the index ring.

The rotating alidade 8, on the diametrically-opposite ends of which are mounted two diopters,- the ocular 9 and the objective 10 and the indexes 3, which are designed for reading on the internal division of the index ring, serves to visual observation of the bearings.

Two screws 11 serve to fasten the alidade: the second screw ensures convenient use during observations.

The objective 10 with the thin thread in the centre serves too aim at the object concerned, and the ocular 9 with a narrow clearance is designed for the observer. For rough aiming the diopters are provided with the sight 12 and the notch 13. The dippters rotate on knuckles 14 and are vertically adjusted to operating position. When put into the box they are put together: the objective is then under the ocular and does not touch the glass or the other diopter.

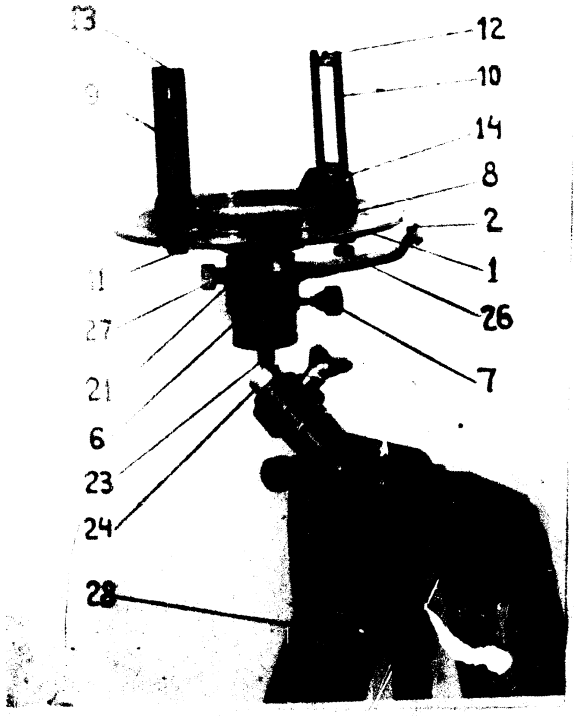

Fig. No. 1.

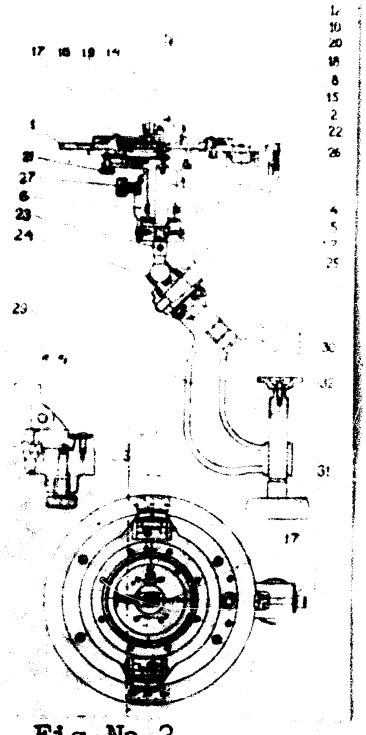

Fig.No.2.

In the centre of the index ring there is the compass, in the box of which the ring 15 is fastened with four diametrically opposite lines, which correspond to the diameters of the index ring, 0^{o} - 180^{o} nad 90^{o} - 270^{o}. The compass box turns simultaneously with the index ring.

The sharply ground pivot 16, to which is put the magnetic needle 17, balanced by the movable loading weight 18, is screwed in the centre of the compass. To the central part of the magnetic needle is hermetically pressed the head 19 inside of which is the agate footstep bearing to eliminate friction and make the rotation of the needle easy. During the transport the head of the needle is clamped by the screw 21 to the glass 20 by the arresting device, which prevents the pivot from the blunting.

The globular level 22 with two round marks, which serve to set the instrument to horizontal position, is plastered in a special frame. The distance between the marks equal to 2 mm , which corresponds to the value of 7′- 15′.

The frame with level is screwed to the end of the index ring by three screws, which allow to adjust and regulate it.

The hub 6 has the globular axis 23, which is inserted during the installation of the goniometer into the muff with a notch in the clamp screw 24.

The goniometer, installed in horizontal level, by means of the globular foot and muff is fastened by the screw 25. The globular axis and the notch in the muff 24 make possible to adjust the instrument into horizontal level under different fastening conditions of the clamps screw.

The stirrup 26 with the index MK 2 rotates on the hub 6. The stirrup may be fastened by the screw 27 in any position.

The goniometer is fastened to the camera-stand 28 or to the airplane by means of the clamp screw 29 in the form of a horse-shoe, one end of which is provided by a rubber cushion 30 and into the other the clamp screw 31 with the footstep bearing 32 is screwed.

IV. Installation of the goniometer.

Before we begin to operate with the goniometer, it is necessary to install it to operating position, to which purpose :

1. The camera-stand should be installed and the clamp screw should

be screwed to it. To this purpose the clamp nuts of the feet of the camera-stand should be loosened and set into stabile position: it depends upon the height of the observer, if the camera-stand is adjusted higher or lower. Then the clamp nuts on the feet of the tripod should be tightened and the stabile position of the camera-stand should be controlled.

2. Put the goniometer into the clamp screw and fasten it slightly by the screw 25.

3. Set the goniometer to horizontal level. During the installation of the goniometer in the globular muff care should be taken that the bubble of the level took the central position in the marks on the ring. Then the globular muff 23 should be definitely fastened by the screw 25. The goniometer may be adjusted to horizontal position by slightly pressing to the shoes on the feet of the camera-stand.

4. Adjust the diopters to vertical position and loosen the screws of the alidade.

V. Control of the goniometer.

1. Make sure that the index ring, the alidade and the stirrup of the index MK rotate continually, without any swinging and badly running (otherwise the goniometer is not suitable for operation).

2. Control the level. In the instrument, adjusted according to the level, the bubble of the level during the rotation of the index ring should not exceed the limits of the external mark.

3. Make sure that the sighting plane (which passes through the ocular and objective diopters (is perpendicular to the plane of the index ring).

Make sure that the thread of the objective is tensioned firmly enough, by placing the plummet at the distance of 8 or 10 m from the goniometer, set the index ring to horizontal level and adjust the alidade in such manner, that the thread of the objective covered the spring. The conform of the thread of the diopter along all the length of the string of the plummet means that the adjustment of the instrument is correct. If it shifts while crosses the plummet, it means that the hair of the objective diopter is inclined: if the thread conforms with the plummet, but the clearance of the ocular diopter is not symmetrical at all the length of the hair, then it means that the cross-sectione of the ocular diopter or the diopter itself is not perpendicular to the plane of the index ring.

4. Control the correct position of the lines of the compass. The lines of the compass ring should be in one line with the divisions of the index ring 0° - 180° and 90° - 270°. While setting the diopters to horizontal level, adjust the indexes to 0° - 180° and 90° - 270°. The thread of the sighter should then cover the lines of the ring of the compass. In case that this condition is not fulfilled, the determined bearings should be corrected.

5. The needle should be balanced by longitudinal shifting of the loading weight, which is placed on the southern end of it,i.e. at the horizontal position of the index ring its ends should lie in the same plane as the plane of the compass ring.

6. The magnetization property of the needle of the agate polish and the degree of blunting of the pivot is controlled by the following manner : the needle is takne out of the quiet condition to the angle 90° by means of any ferrous object and then it is releases: the needle should do at least five full swings to be quieted again. In case that this condition is not fulfilled, the compass should be repaired by the mechanis.

VI. Determination of the magnetic bearings and the adjustment of the airplane to the course according to border bearings.

The magnetic bearing MP of an object is called the angle between the magnetic meridian and the direction to the object. The angle is read from the northern end in clockwise direction from 0 to 360°.

The border bearing BP is called the angle between the longitudinal axis (plans of symmetry) of the airplane and the direction to the object. The angle is read from the nose part of the airplane in clockwise direction.

The magnetic course MK is called the angle between the magnetic meridian and the longitudinal axis of the airplane, which is read from 0° to 360° in clockwise direction.

The relation between the bearings and the magnetic course is quoted below : $MP = MK + BP$

$BP = MP - MK$

The platform for the determination of magnetic bearing is selected on the side remote from the great accumulation of ferrous masses.

The determination of the magnetic bearing MP of the object is based upon the following:

The index ring should be oriented along the magnetic meridian that 0° were directed to the south and 180° to the north. Loosen the screws of the alidade, look at the aimed objects (which should not, if possible be nearer that 1000 m) and take the reading on the inner divisions of the index opposit to the index of the ocular diopter. The external scale of the index ring is designed for reading on the index MK in case when the direction of magnetic course MK is being determined, which case will be discussed below.

To adjust the airplane to various courses it is sufficient to take one bearing. However, to eliminate the possibility that the aimed object will be covered by some component of the airplane, it is necessary to take bearing for two or three objects, which are placed beyond the border of the aerodrome, calculated in such a way, that the differences between the bearings were in the renge of 100° - 120°.

During the determination and compensation of the deviation it is usual to adjust the airplane to eight principal courses - N, NE, SE, S, SW, W, and NW.

Consequently, to calculate the border bearings, it is necessary to establish 2 - 3 tables of border bearings, corresponding to the taken magnetic bearings of the objects and to the given courses according to the formula : $BP = MP - MK$.

Example : three magnetic bearings were taken: 1) pivot - 50°
2) radiomast -150°
3) factory chimney -302°.

The readings should be taken in whole grades, - it is supperfluous to take portions of grades. Then the table of the border bearings according to the first magnetic bearing is established :

MK	MP - MP	=	BP
N	50° - 0°	=	50°
NE	50° - 45°	=	5°
E	50° - 90°	=	320°
SE	50° - 135°	=	275°
S	50° - 180°	=	230°
SW	50° - 225°	=	185°
W	50° - 270°	=	140°
NW	50° - 315°	=	95°

The tables for the second and third magnetic bearing is obtained in the same manner :

MK	BP for the second MP	BP for the third MP
N	150°	302°
NE	105°	257°
E	60°	212°
SE	15°	167°
S	330°	122°
SW	285°	77°
W	240°	32°
NW	195°	347°

From the above illustrated tables it is obvious that the border bearing for the adjustment of the airplane to the course N equal to MP, (magnetic bearing), and each following bearing is smaller than the preceding by 45°. On subtracting 45° from the last border bearing, the first bearing is obtained, which serves as a control for the calculation.

During the adjustment of the airplane to the course the change of the bearing should be taken into account, if the goniometer shifts from the bearing point.

The table of the magnetic bearing change in minutes , depending upon the distance of the aimed object and upon the shifting of the goniometer from the side of the original place of observation, is shown below.

The deviations of the bearings to 10′ are considered tolerable.

The tolerated deviations are separated in the table by the thick line.

Distance of the aimed objects	Shifting of the goniometer to the side m						
	1m	2m	3m	4m	5m	10m	15m
500	7′	14′	20′	27′	35′	109′	143′
1000	3′	7′	10′	14′	17′	34′	52′
2000	2′	3′	5′	7′	9′	17′	26′
3000	1′	2′	3′	4′	6′	11′	18′
4000	1′	2′	3′	3′	4′	8′	14′

The objects having been aimed, the airplane is installed to the place of the goniometer to the horizontal flight position.

The goniometer is fastened on the airplane in such a way, that the line 0° - 180° conformed with the longitudinal axis of the airplane or were parallel with it, the 0° being directed to the tail of the airplane. Then the index is fastened, the alidade is installed to such reading, which equals to the border bearing, and the airplane is being

turned until the aimed object appears in the sighting line, after which the airplane may be considered adjusted to the course.

After the adjustment of the airplane to the course N according to the first border bearing the alidade should be aimed to another visible object, and if the reading on the index ring equals to the border bearing BP, then the airplane is adjusted correctly. Then the readings of the courses KK should be recorded from the compasses on the airplane.

The difference between the bearings of the given MK and those which are taken from the compass, will give the value of the compass deviation.

The compass deviation is expressed according to the formula

= NM - KK .

The order of determination of the compensation of the hemispherical compass deviation according to the Airy technique is shown in the corresponding instructions.

VII. Adjustment of the airplane according to magnetic bearing

Beside of the above mentioned manner of adjusting the airplane to the course according to previously calculated bearings this goniometer enables the adjustment of the airplane to the course without previous calculation of the border bearings by means of the movable index with the designation MK and the external scale.

The adjustment to the course should be accomplished in the following manner: after the installation of the index ring in the plane of symmetry of the airplane (0° to the tail and 180° to the nose) the movable index with the designation MK should be installed opposite to 0° and fastened by the screw. Then the alidade should be adjusted to the reading MK of the object on the internal scale and should be fastened. By turning all airplane try to get to several positions until the aimed object will conform with the sighting line. The airplane in that position will be in the course O/N.

To adjust the airplane to the following course, the index ring simultaneously with the fastened alidade should be installed in the relation to the immovable index with the designation MK to the required course. The magnetic course is read on the external scale. After the adjustment all airplane is turned in order to get to such position that the aimed object will conform with the sighting line. This process should be kept

all following courses, till the deviation will be eliminated. If we do not succeed in adjusting the airplane exactly to the course, and the aimed object will not conform with the sighting line, the whole of the index ring should be controlled until it will conform with the object and the magnetic course of the airplane is read on the external scale.

On eliminating the deviation care should be taken that the index ring or the index with the designation MK did not deflect from the axis of symmetry of the airplane.

VIII. Installation of the goniometer on the airplane.

The airplane should be set on the platform to the horizontal flight position. Two plummets are lowered from the points, which are purposely chosen on the plane of symmetry. Then the deviation goniometer installed on the tripod is carried over to the tail of the airplane, and gradually such position of the goniometer is selected, that the goniometer were in the plane, which passes through the plummets, and its centre lay in that plane, i.e. on the prolonged axis of symmetry of the airplane. Then the magnetic needle of the goniometer should be fastened and may not be used at all. The exact installation of the goniometer is obtained by conforming its sighting plane (cross-section and thread) to the aiming line of the two threads of the plummets. The index ring of the goniometer should be meanwhile oriented in such manner, that the zero position on the index ring were below the index of the ocular diopter.

Such adjustment having been reached, the index ring of the goniometer should be firmly fastened and 2 - 3 bearings of the remote objects be taken. The taken bearings are the border bearings of the objects at given course of the airplane, if the goniometer was installed near to the airplane and the aimed objects were sufficiently remote (see the table of the tolerated shifts).

Having recorded the border bearings, the goniometer without the tripod should be carried over to the airplane and fastened in the cabin in such a manner that the greatest out-look on all sides of the horizon were ensured. Then the index ring of the goniometer should be horizontally and oriented in relation to the plane, 180° to the nose of the airplane). In order to reach the exact orientation of the index ring, the alidade is adjusted in such manner, that the index of the ocular

diopter were on the division of the index ring, corresponding to one of the border bearings of the objects, taken on the ground.

Then by turning all index rings of the goniometer simultaneously with the alidade, the covering of the corresponding object by the thread of the objective diopter is reached, while the adjustment of the alidade on the index ring is not disturbed. Then the index ring of the goniometer should be definitely fastened and its installation should be controlled by taking other bearings of the objects.

At the corner orientation of the index ring of the goniometer, the bearings of the objects, taken from the airplane, should conform to the bearings of the same objects, taken on the ground.

IX. Goniometer maintenance.

After the operation the goniometer should be put into the box in such manner that all its parts were tightly put to special nests in the box. The transport of the goniometer of the camera-stand is not allowed. If during the putting of the goniometer into the box the cover of the box does not get closed, then the cause of it should be revealed and eliminated, but in no case force should be employ.

Every time before the putting of the index ring into the box the indexes of the alidade should be set to the readings 0° - 180°.

The screw of the clamp should be tightened as much as possible, the screw of the globular axis should be screwed and inclined to the side of the wall with the hooks (in the box).

It is not allowed to leave the goniometer or the camera stand without any supervision. After finishing the operation it is necessary, by using the arresting device, to fastened the needle to the glass, because otherwise during the transport the needle will knock against the pivot and blunt it, which may disturn the operation of the compass. The arrestir device should be loosened only after the instrument has been definitely installed and set to horizontal position. If it rained during the operation, then the instrument should be dried and lubricated by the oil. When operating with the instrument it is not allowed to touch the division scale of the index ring by hands, because due to the contact with hands covered with sweat the index ring might corrode. If during the operation one finds out that the alidade turns with difficulty, then the force should not be employed and the cause should be revealed.

Otherwise the instrument should be handed over for repair and correction. The observer himself should not take the instrument to pieces, in order to eliminate the soiling and damage of the rubber parts. During the long storage of the instrument, all parts of it should be periodically carefully inspected to find out corrosion and other defects, which should be removed by a clean rag, soaked with oil.

The storehouse where the instruments are kept should be dry and should have normal room temperature. It is not allowed to store the instruments in moist cellars and on places with rapid temperature changes. Neither should the instrument be kept near the windows, on the sun or near to ovens (batteries) and in the vicinity of great ferrous massives.

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MODERNIZED INVERTER UNITS

TYPES

MA-100M, MA-250M

Technical Features and Operating

Instructions

TECHNICAL FEATURES OF THE INVERTER UNITS

1. Field of Application and General Characteristics

Type MA-100M and MA-250M modernized inverter units [illegible] 1 and 2/ , in production since 1954, supersede the type MA-100 and MA-250 line of inverters and serve [illegible] inversion [illegible]-volt d.c. power [illegible] single-phase , 400 [illegible] 115-volt [illegible]. They are employed [illegible] aircraft for [illegible] [illegible]al equipment .

[illegible]ese modernized [illegible] completely [illegible] corresponding [illegible] earlier manuf[illegible] [illegible] technical [illegible], also as to [illegible] circuit [illegible]. [illegible] comparison [illegible] earlier [illegible] modernized [illegible] greater degree [illegible] [illegible] with respect [illegible] the [illegible] a more effici[illegible] regu[illegible], by the elimina[illegible] contactors [illegible] the [illegible] boxes to shunt [illegible] starting windings [illegible] MA-250M [illegible] / and by the employment of more reliable type [illegible] line [illegible]actors in place of type K-40[illegible] contactors .

The type designation of the inverter unit is based upon the following notation . MA is the series designation of this line of units ; numerals 100 and 250 denoting the a-c power output in va ; while the suffixed letter M indicates that the unit is a modernized model .

The type MA inverter comprises a unit consisting of two electrical machines ; a d-c motor and a single-phase a-c generator built with an integral frame and on the same shaft.

The starting and control apparatus is arranged in a control box fastened on the frame of the unit .

The motor in this unit is a four-pole , compound-wound d.c. machine the series winding of which is furnished to facilitate starting of the unit .

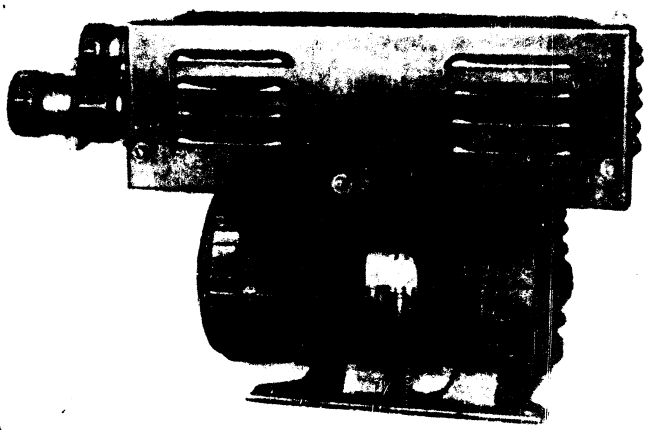

Fig. 1 Ex[illegible] Unit

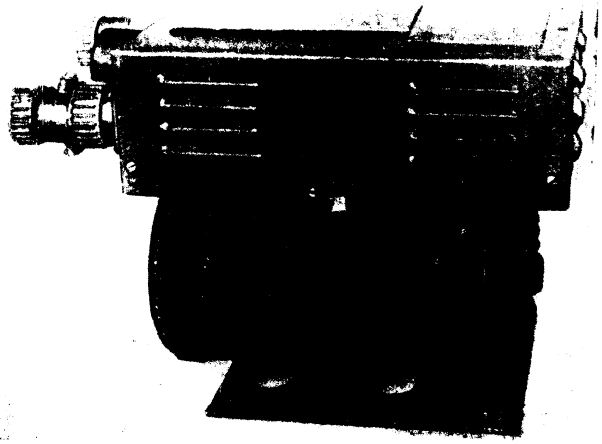

Fig. 2. External view of Type MA-250M Inverter Unit

The elementary circuit diagram of the MA series inverters is given in Fig.3.

Detailed circuit diagrams for each type of inverter are given in the section " Circuit Connections and Principle of Operation of the Inverters".

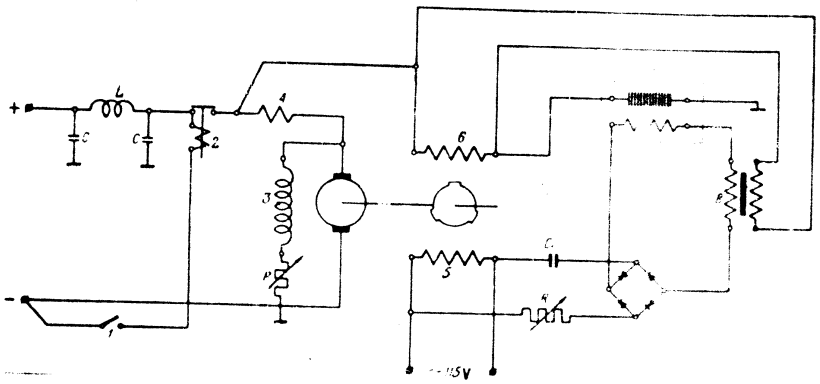

Fig.3. Elementary circuit connections of MA series inverter units / simplified diagram/

1- Starting knife switch; 2- Starting contactor ; 3- Shunt field winding ; 4- Series field winding ; 5- Generator working inductor / winding ; 6- Generator field winding ; 7- Carbon-pile voltage regulator ; 8- Stabilizing transformer ; 9- Selenium rectifier .

On its a-c side the inverter is a single-phase a.c. generator of the inductor type , with electromagnetic field excitation . The field system of the generator , excited by d.c. , and the working a.c. winding in which the a-c voltage is induced , are stationary in space / see Figs . 3,5 and 6/.The rotor / inductor/ is made in the form of a three-salient-pole stack of stampings fastened on a steel sleeve and serves as part of the magnetic circuit . From the above , it follows that

inductor type generators do not have sliding contacts which represents an essential advantage in comparison with other types of a-c generators.

The working / or stator/ winding of the generator consists of six series [illegible] coils [illegible] fastened on the stator projections / poles/. The magnetic flux produced by the ampere [illegible] of the [illegible] d.c. field winding, which is designed in the [illegible] of a [illegible] encircle the projecting [illegible] hub [illegible] the [illegible] the steel [illegible] shield, [illegible] the air gap between the hub and [illegible] then through the rotor sleeve [illegible] the rotor and [illegible] the air gap between [illegible] steel [illegible]

The [illegible] shown in Fig. [illegible] During [illegible] the projections [illegible] projections of the [illegible] magnetic circuit is a minimum [illegible] is a maximum when the projections [illegible] between the projections [illegible] between the rotor and the stator [illegible] greatest value, the reluctance is [illegible] maximum. Rotation of the rotor, hence [illegible] of the flux because of change in reluctance of the magnetic circuit, the pulsation taking place without change in direction from a maximum to a minimum value. The pulsations of the flux, in turn, induce an alternating e.m.f. in the stator windings.

the frequency /f/ of which is determined by the speed of rotation , and number of polar projections or teeth on the rotor, i.e.:

$$f = \frac{n\ Zp}{60} \quad \text{cycles/sec.}$$

where : n = rotor speed in r.p.m.

Zp = number of polar projections on rotor

The r.m.s. value of the stator e.m.f. , at no-load , and for a sinusoidal voltage curve , can be determined by the formula:

$$Eo = 2.22\ W_k\ Nf\ /\Phi max. - \Phi min. / 10^{-8} \text{ volts}$$

where :

W_k = number of turns per coil

N = number of stator coils

f = frequency in cycles/sec .

$\Phi max.$ = maximum value of the flux , in maxwells

$\Phi min.$ = minimum value of the flux , in maxwells

$\Phi min.$ has a value of about 5 - 10% of Φ max.

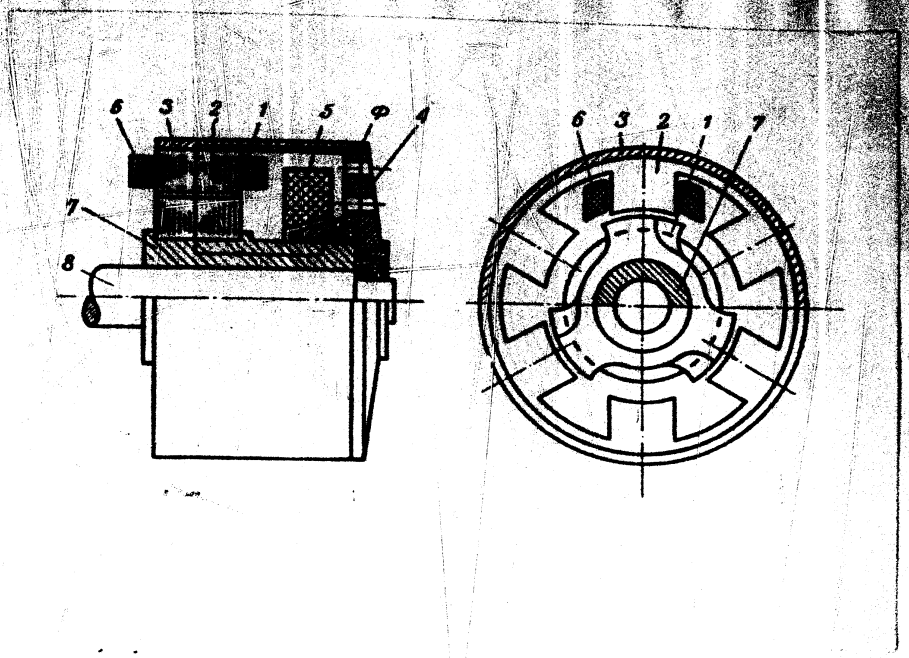

Fig.4. Path of the flux.

1 - Rotor ; 2 - Stator ; 3 - frame; 4 - Steel end shield; 5 - Field winding ; 6 - Stator coil / shown on one polar projection / ; 7- Steel rotor sleeve ; 8 - Inverter unit shaft ; φ - magnetic flux.

The change in the total reluctance of the magnetic circuit of the generator is mainly dependent upon the change in reluctance of the air gap between the projections or teeth of the stator and the rotor . The reluctance of the remaining sections of the magnetic circuit is practically constant , providing that the relatively small changes in reluctance due to magnetic saturation are not taken into consideration . As the radial distance between the rotor and stator teeth is constant , the change in the reluctance of the air gap is , consequently , a function of the change in relative overlapping of the teeth of the stator by the teeth of the rotor which is determined by the ratio of stator-tooth width to rotor-tooth width , and by the amount to which the rotor teeth are chamfered.

A sine wave of e.m.f. in the generator is ensured by [illegible] of a satisfactory tooth-width ratio and chamfering of the [illegible] teeth .

To obtain an a.c. generator voltage of constant value within definite limits of change in load and in supply-circuit voltage , the NA series inverters have carbon-pile voltage regulators included in their circuits .

Stabilization of the a.c. output voltage of the unit is realized by regulating the flow of current in the generator field winding with the aid of carbon-pile voltage regulator 7 / see Fig. 3/. The generator field winding 6, is excited from the d.c. supply circuit of the aircraft through the series - connected carbon pile of the voltage regulator . The voltage applied to the voltage regulator coil is taken off from generator stator winding 5 through full-wave connected selenium rectifier 9 . For increased stability of the voltage during transient processes , stabilizing transformer 8 is also included in the circuit .

In addition , the inverter circuit is provided with adjusting resistors R in both the field circuit of the motor and the feed circuit of the voltage-regulator coil.Capacitors C_1 are provided for increased stability of the voltage in accordance with the frequency of the current. A choke-and - capacitor filter consisting of capacitors C and choke L are included in the inverter circuit for radio-interference suppression .

All the components included in the circuit of the inverter unit are arranged in the control box with the aid of which the following operations are controlled :

a/ remote starting and stopping of the inverter unit;

b/ regulation of the level of the generator voltage ;

c/ transfer of d.c. aircraft supply to the terminals of the plug-in coupler .

These inverter units are of the protected open type , with axial-flow air cooling accomplished by the blower on the motor end of the shaft . The cooling air is drawn into openings in the cover or hood on the generator side and, after passage through the axial cooling passages of the unit, is discharged by the blower through the louvers arranged in the hood of the commutator end.

II . Main Characteristics of the Inverter Units

The inverter units are designed to operate normally under the following conditions :

1. Ambient temperature . . . . from -60° to +50°C
2. Relative humidity . . . . . up to 98%
3. Vibration of mounting :

a/ frequency , withing limits of ...from 30 to 80 cycles/sec.

b/ amplitude corresponding to overload ..... 4 g

These inverters are able to withstand the short periods of shocks incident to take-off and landing of the aircraft .

Nominal Inverter Ratings and Characteristics of the Brushes and Ball Bearings

Description	Type of Inverter	
	NA-100M	NA-250M
1	2	3
Ratings		
Supply voltage , V	27	27
A-c voltage , V	115	115
Load current taken from d.c. circuit , A	11	25
No-load current at rated supply voltage , A	6.5	6.5
A-c output current /load/ , A	0.87	2.17
Power factor under inductive loads	0.9	0.9
Power output , va	100	250
Speed , r.p.m.	8000^{+800}_{-400}	8000^{+800}_{-400}
Frequency , cycles/sec.	400^{+40}_{-20}	400^{+40}_{-20}
Efficiency , %	not under 28	not under 38
Transfer-circuit current rating , A	not over 5	not over 5
Duty	continuous	continuous
Weight , kg	not over 7.2	not over 10

1	2	3
Brushes		
Grade of brushes	МГС-7	МГС-7
Number of brushes	4	4
Number of brushes carried by a brush stud	1	1
Brush dimensions , mm	6.5x7x16	6.5x12x20
Ball Bearings		
No. of ball bearing / USSR Standard /	200 , class II	200, class II
Bearing libricant, grade	ОКБ-122-7	ОКБ-122-7

Notes: 1. The output voltage is held to within 115 ± 3.5 volts under changes in a-c load varying from full rated value to 30% of rated value with the d.c. supply voltage within limits of 27 ± 2.7 volts and at a normal ambient temperature .

2. The d.c. load current may exceed the value given in the Table , but the efficiency at the end of a run under rated conditions should not be less than the values listed in the Table.

III. Guaranteed Term of Operation

The type NA-100M and MA-250M Inverter units are to operate with full availability over 600 hours of flight in the course of 4.5 years , including 3 years of actual service on an aircraft , the remaining time to be either in shipment, or in storage in a warehouse of the Purchaser or User. Should the time of shipment and storage exceed the time stated above, the available period of actual service on an aircraft is to be correspondingly shortened .

NOTE: Inverters intended for reserve storage have a 2-year storage-period guarantee which is ensured by special means of conservation . The total calendar period of guarantee for such units is correspondingly increased .

1Y. Volume of Delivery

The volume of delivery of the inverter units is to conform with the equipment listed in Table 1.

Table 1

Inverter Volume of Delivery

Item	Description	Type of Inverter MA-100M Works drwg No.	MA-100M Quantity	MA-250M Works drwg No.	MA-250M Quantity	Notes
	Equipment Included in the Inverter Delivery					
1.	Inverter unit proper	002.150	1	002.149	1	
	Spare Parts					
2.	Brush/assembly/	555.041	4	555.039	4	
	Tools					
3.	Screw driver	-	-	986.001	1	
	Documents					
4.	Certificate	-	1	-	1	

y. Description

General Design

All modernized inverter units of the MA series , as to desigh , are indentical , for this reason this description of their design applies to all of these units .

MA series units consist of two main elements :

1/ a single-frame motor-generator unit comprising a d.c. motor and a single-phase a-c generator ;

2/ a /KCV control and stabilizing box which is fastened to the frame of the unit and which contains all the starting-regulating apparatus of the unit .

Motor-Generator Outfit

The motor-generator outfit consists of the following main assemblies : frame , armature , commutator-end bracket , flanged rotor-end bracket , blower , hoods or covers , two supports / for securing the unit to its mounting and for fastening the control box to the unit /.

Armature 12 / Figs. 5 and 6/ of the electric motor and rotor 24 of the generator are fastened on the common shaft 25 which runs on ball bearings 21. Shaft 25 is made of constructional steel , and, at the ends , is provided with threaded journals for nuts 22 and 26 with the aid of which the inner races of ball bearings 21 and blower 28 are fastened upon the shaft , On its central part , the shaft has a straight-knurled surface on which is pressed aluminium sleeve 13,made in the form of a three-armed spider on which , in turn , the motor - armature-core stack is fastened .

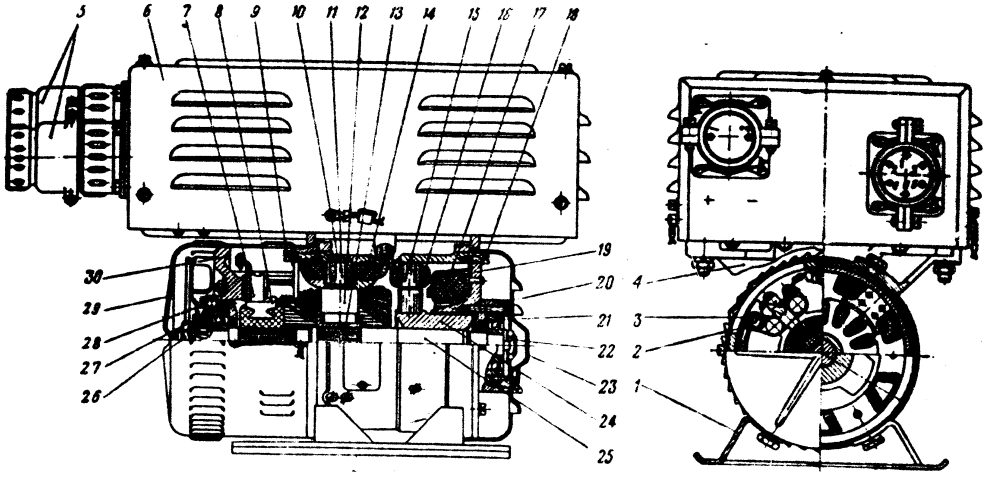

Fig.5. Type MA-100M Inverter Unit

1 - Support; 2 - Spring; 3 - Brush-holder; 4 - Support; 5 - Plug-in-coupler; 6- Control box; 7 - Brush; 8 -Commutator; 9- Screw; 10- Frame; 11- Pole piece; 12 -Armature; 13-Sleeve; 14 - Coil of motor field winding; 15- Stator; 16 -Coil of generator main winding ; 17 - Coil of generator field winding; 18 - Screw ; 19 - Generator-end bracket ; 20-Bearing housing; 21- Ball bearing ; 22 - Nut; 23 - Hood; 24- Rotor; 25- Shaft; 26 - Nut ; 27 - Flange; 28 - Blower ; 29- Hood; 30 - Motor-end bracket .

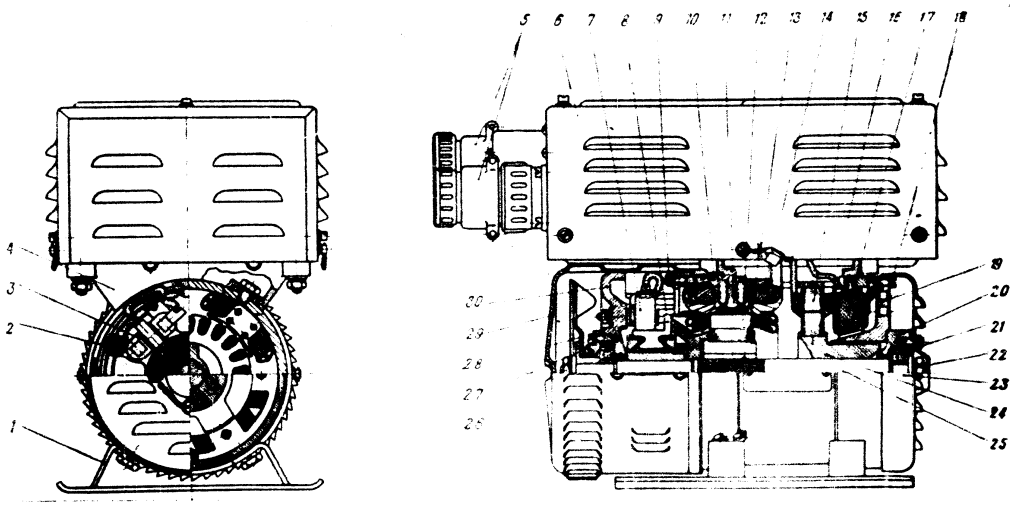

Fig.6. Type MA-250M Inverter Unit

1 - Support; 2 - Spring; 3- Brush-holder; 4- Support ; 5 - Plug-in coupler ; 6- Control box; 7 - Brush ; 8 -Commutator; 9- Bolt; 10- Frame; 11- Pole piece ; 12- Armature ; 13-Sleeve ; 14 - Coil of motor field winding ; 15- Stator ; 16- Coil of generator main winding ; 17 - Coil of generator field winding; 18 - Screw; 19- Generator-end bracket ; 20- Bearing housing ; 21 - Ball bearing ; 22- Nut ; 23 - Hood; 24- Rotor; 25-Shaft ; 26- Nut; 27 - Flange ; 28- Blower ; 29 - Hood; 30- Motor-end bracket .

The motor armature stack is built up of 0.35 mm thick No.1 electro-technical steel stampings . The slots of the armature carry the motor armature winding , the coil-section ends of which are carefully tin-soldered to the bars of co

In the moto of type MA-100M and MA-250M inverter armature winding is wound with a round wire. Motor winding data is listed in Table 2.

Table 2.

Motor Armature Winding Data

Description	Type of Inverter Unit	
	MA-100M	MA-250M
Kind of winding	Wave	Wave
Method of winding	Hand wound	Hand wound
Number of slots	15	21
Grade of wire	[illegible]	[illegible]
Wire diameter /size/ over bare wire , mm	1	1.35
Wire diameter over insulation, mm	1.185	1.56
Number of active conductors in a slot	24	12
Coil sides per slot	6	6
Number of turns in each coil	4	2
Number of parallel circuits	2a=2	2a=2
Slot pitch	1-5	1-6
Commutator pitch	1-23	1-32
Number of commutator bars	45	63
Resistance of armature winding at a temperature of 20°C, ohms	0.12± 10%	0.062±6%

For insulation of the slots , electrical pressboard , grades ЭВТ1,3,7 and grade ЛЩ2 varnished cloth is used .

Winding 4 , at the top of the slot , is kept in place by wedge 5 , of grade ЭВТ electrical pressboard .

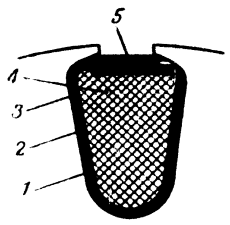

Fig.7. Shape and insulation of inverter unit armature slots / For types MA-100M and MA-250M/

1, 2, 3 - Layers of slot insulation ; 4- Winding wire ; 5 - Slot wedge.

To protect the armature winding from bulging under the action of centrifugal forces developed during rotation of the armature , besides the wedges in the slots, the coil ends are banded with high-tensile-strength steel wire . In addition to this , for increasing the mechanical strength and attainment of higher insulation resistance , as well as for protection against moisture and brush dust , the armature is impregnated with an insulating varnish .

Commutator 8 / see Figs. 5 and 6/ is built up of special-shaped bars of cadmium-alloyed copper held together by two conical pressure rings drawn up tight by a round nut.

In MA-100M units the commutators are assembled on a moulded plastics base , the individual bars being insulated from each other by mica segments and the ends of the commut insulated from the pressure rings by conical mica

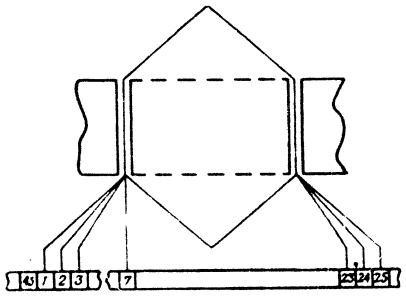

Fig.8. Arrangement of coil in armature slots and soldered connections of its leads in the MA-100M unit.

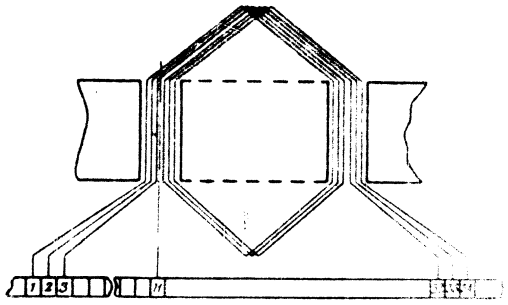

Fig. 9. Arrangement of coil in armature slots and soldered connections of its leads in the MA-250M unit.

Rotor 24 of the a.c. single-phase generator is press fitted on the end of shaft 25 . The rotor has three polar projections or teeth , skewed through a stator-tooth pitch . To lower the iron losses in the rotor teeth , the core is built up of electro-technical steel stampings of 0.35 mm thickness fastened on a massive low-carbon steel sleeve .The sleeve , together with the shaft , serves as a part of the magnetic circuit .

To reduce the unbalance of the armature , the latter is dynamically balanced by tin soldering the armature windings .

Frame 10 is common for both the motor and the generator. It has the form of a sleeve of low-carbon steel , the end faces of which are drilled and tapped for fastening of the end brackets , and is galvanized to protect it against corrosion. On the inside of the frame four pole pieces 11 , which carry the field winding coils 14, are fastened , It also carries the pressed stator core 15 with coils 16 of the generator working winding , and the generator field coil 17.

Pole pieces 11 are assembled of electro-technical steel stampings , secured together by the aid of four studs. In all these units , the field coils 14 , consist of two windings, a shunt field winding and a series field winding wound over the shunt field winding . The coil-to-coil connections are made with the use of multiple-strand wiring cable.

The coils , after winding , are insulated with grade MM2 varnished cloth and cotton taped . Tight fitting of the coils on the poles , vacuum impregnation , and joint drying, together with the poles which are secured to the frame by screws , ensure a monolithic assembly. To prevent self-loosening of the screws , their heads are centre-punch peened in at the

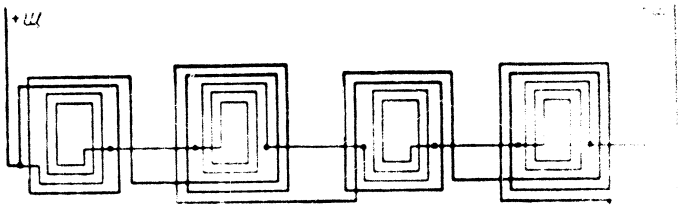

Fig.10. Developed winding diagram and coil connections of the shunt and series windings of the motors of type MA-100M and MA-250M inverter units.

TABLE 3

Winding data on the motor field coils is given in Table 3.

Motor field coil data

Description	Type of Inverter Unit			
	PA-100K		PA-250K	
	Shunt Coil	Series Coil	Shunt Coil	Series Coil
Grade of wire	PEL		PEL-2	
Wire wire dia., mm	0.41	1.5	0.41	1.81
Dia. over insulation, mm	0.45	1.41	0.45	1.93
Number of turns of coil series on 1 pole	400	2	370	1
Resistance of one coil at 20°C, ohms	5.25	-	3.15	-
Total resistance of field winding at 20°C, ohms	21.0±6%	0.17±10%	20.6±6%	0.066±6% including leads

The generator stator 15 / See Figs.5 and 6/ has six polar projections or teeth and is built up as a core stack.

The core is assembled of electro-technical stampings 0.35 mm thick which are tightened together by six rivets insulated from the stampings by cable paper and bakelite varnish. The outside cylindrical surface of the core is ground and the core is then pressed into the frame and is secured with the aid of clamps and three screws. Coils 16 of the generator working winding are arranged on the stator

1	2	3
Bare wire dia., mm	0,35	0,53
Dia. over insulation, mm	0.41	0.58
Number of turns in series per pole	150	100
Total number of turns per phase	900	600
Resistance of winding at 20°C, ohms	12.8±8%	4.62±10%

The generator field winding is made in the form of a ring-wound coil 17 , fastened within the frame with the aid of metal bands or straps under which electrical pressboard liners are arranged. In MA-100M units the coil is attached to flanged magnet 19. A winding diagram of the generator field coil is shown in Fig.12. After winding , the coil is insulated with a wrapping of grade ЛЧЛ2 varnished cloth and cotton tape and then is vacuum impregnated with an insulating varnish .

Winding data on the generator field coils is listed in Table 5.

At the under part of the frame , attached with four bolts , a pressed-steel support 1 is provided for installation of the unit on an aircraft. At the top of the frame a cast aluminium support 4, attached with four bolts,is provided to mount the control box. For passage of the leads from the motor and the generator into the control box,special lead-out holes are arranged in the top of the frame.

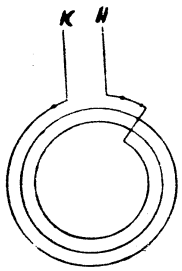

Fig.12. Diagram of method of winding the generator field coil in type MA-100M and MA-250M units .

TABLE 5

Generator Field Coil Winding Data

Description	Type of Inverter Unit	
	MA-100M	MA-250M
Voltage , V	27	27
Grade of wire	ПЭЛ	ПЭЛ
Bare wire dia. , mm	0.49	0.59
Dia. over insulation , mm	0.54	0.64
Number of turns	500	460
Resistance of coil at 20°C, ohms	8.0±8%	6.0±10%

The commutator-end bracket 30 is made of an aluminium alloy and is attached to the frame with four bolts 9. The bolt holes are made oval to allow for adjustment of the commutation by turning the bracket relative to the frame. On the outer side , the bracket has ports for access to the commutator and the brushes.

For inscreased mechanical strength of the bearing housing , a steel bushing is pressed into the bore of the bracket.

To protect the commutator against lubrication which may escape from the bearing , the housing bore of the bearing is furnished with a packing ring of technical felt .

The external end of the bearing housing is closed with flange 27 , secured to the bracket by four screws and provided with a groove for a packing ring.

To decrease radio interference due
commutator of the motor , capacitor
bracket and are connected betwe
/ frame/.

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are arranged , two of which are di
bracket itself / ground / , the remain
the bracket by pads of textolite insulati
brush connection , the brush-holders are conn
by means of connection cables. The bracket holes
which the brush-holder fastening bolts are passed ar
with plastics bushings .

In the MA-250M unit a brush-holder stud is soldered or brazed to the brush-holder plate . This stud carries a bushing provided with a slot to receive the internal end of the watch type brush spring 2. Brush pressure is adjusted by turning the bushing , the surface of which is provided with a series of holes by means of which the bushing is fixed in place on the stud by a cotter pin. In the MA-100M unit , the brush-holder stud , into the slot of which the engaging end of the spring is inserted , is fastened in the brush-holder plate with the aid of a nut. Brush pressure adjustments are made by turning the stud and the spring. To prevent self loosening of the stud , the latter is locked in place by means of a special lock-finger washer.

The normal values of brush pressure are listed in Table 6.

To decrease radio interference due to the brushes and commutator of the motor , capacitors are arranged inside the bracket and are connected between the brush-holders and ground / frame/.

On the inner side of the bracket four brush-holders 3 are arranged , two of which are directly connected to the bracket itself / ground / , the remaining two being insulated from the bracket by pads of textolite insulation . For brush-to-brush connection , the brush-holders are connected in pairs by means of connection cables. The bracket holes through which the brush-holder fastening bolts are passed are fitted with plastics bushings .

In the MA-250M unit a brush-holder stud is soldered or brazed to the brush-holder plate . This stud carries a bushing provided with a slot to receive the internal end of the watch type brush spring 2. Brush pressure is adjusted by turning the bushing , the surface of which is provided with a series of holes by means of which the bushing is fixed in place on the stud by a cotter pin. In the MA-100M unit , the brush-holder stud , into the slot of which the engaging end of the spring is inserted , is fastened in the brush-holder plate with the aid of a nut. Brush pressure adjustments are made by turning the stud and the spring. To prevent self loosening of the stud , the latter is locked in place by means of a special lock-finger washer.

The normal values of brush pressure are listed in Table 6.

TABLE 6

Normal values of Spring Pressure Upon the Brushes

Type of Unit	Brush Height, mm	Spring Pressure upon Brush, g
MA-100M	14.5	200± 20
MA-250M	18	200± 50

Flanged bracket 19 on the generator-rotor end consists of two parts fastened together by four screws. The external part of the bracket, of low-carbon steel, has a protruding internal hub and serves as part of the generator magnetic circuit. The internal duraluminium part of the bracket serves as the ball bearing housing. For inscreasing the mechanical strength of the housing, it is provided with a steel housing liner / except for MA-100M units /. Bracket 19 is fastened to the frame by screws 18, under the heads of which spring washers are placed. The end-face surface of the bracket is designed with openings for passage of the air sucked into and along the frame of the unit by the blower.

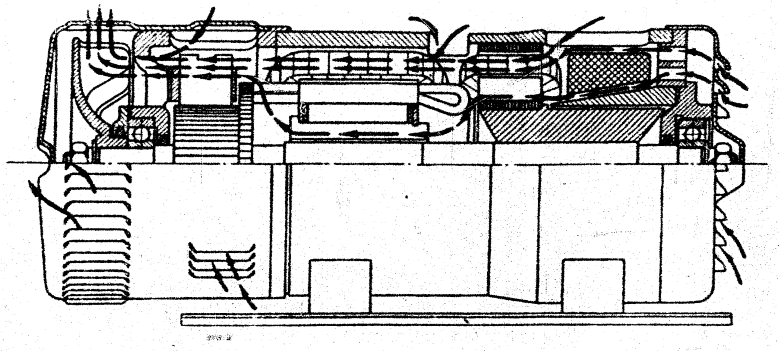


Fig. 13. Path of cooling air

Blower 28 is fastened on shaft 25 at the commutator side with the aid of a key and nut 26 . It is of stamped sheet steel design.

When the unit is in operation , the cooling air / Fig. 13/ is taken in at the generator-end hood through the louvers in the hood , whence it passes through the openings in the flanged bracket , flows between the poles along the surface of the armature and over the commutator and is discharged by the blower through louvers in the commutator-end hood . An additional amount of cooling air also enters the intake louvers in the commutator-end hood and the control box.

Brackets 19 and 30 are enclosed by aluminium hoods 23 and 29 which are attached to the brackets by screws , the heads of which are locked by binding wire passed through each pair of heads .

Control box.

A type KC) control box is installed on the frame of the inverter unit. In it , with the aid of mounting straps and screws , are fastened the starting contactors , the voltage regulator , the stabilizing transformer , selenium rectifier , vitreous-enamelled resistors , the choke and the filter capacitors . The box is of pressed sheet steel . Holes for entrance of the wiring from the inverter are provided in the bottom of the box. Stiffening ribs are provided in the box for increasing its mechanical strength. On the under side of the box, bolts are welded to its bottom for fastening it to the inverter unit. Inside the box , bolts are welded to it for fastening

the components; the box also has a metal partition to isolate the filter components . The filter , itself,consists of a set of capacitors and a choke .

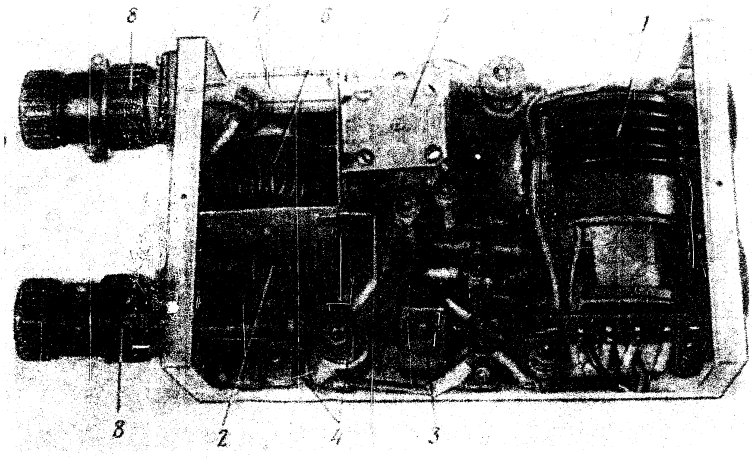


Fig. 14. KC9 -100M control box of the type MA-100M unit / with cover removed/

- voltage regulator ; 2 - Selenium rectifier; 3 - Stabilizing transformer ; 4 - Vitreous-enamalled resistors; 5-Starting contector ; 6 - Filter choke ; 7- Filter capacitors ; - Connection couplers .

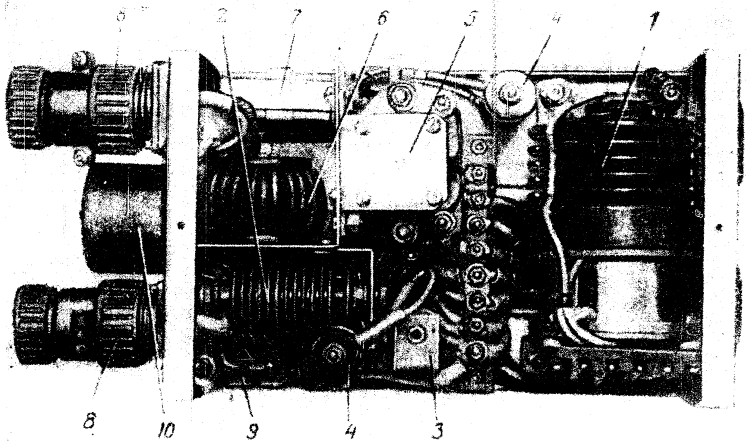


Fig. 15 . КСУ - 250М control box of the type МА-250М unit / with cover removed /

1- Voltage regulator ; 2- Selenium rectifier ; 3 -Stabilizing transformer ; 4 - Vitreous-enamalled resistors ; 5- Starting contactor ; 6 - Filter choke ; 7 - Filter capacitors ; 8- Connectipn couplers ; 9 - Stabilizing capacitors; 10- Voltage-level adjusting rheostat .

On the bottom of the box a moulded plastics transfer terminal strip , equipped with terminal bolts , is installed. The several components are wired with grade БПВД wire, the insulation of which is coloured for convenience in wiring . The wiring is grouped into separate bunches bound together with unbleached thread. The ends of the wires are terminated with sleeves of chlorvinyl compound. For connection of the unit to the load circuits and to the supply circuit , the side wall of the control box is provided with two coupler receptacles . The box is covered with a stamped hood. Spare fuses are provided on a special metal panel near a window in the hood.

For cooling , the side walls of the box and the hood have louvers .

Table 7 lists the units installed in the КСУ control boxes.

TABLE 7 .

List of Units Installed in the КСУ Control Boxes

Name of Unit	Type	Number of units installed in KC box	
		KC -100M	KC -250M
Carbon- pile voltage regulator	РУГ- М	1	1
Contactor	К-50А	1	1
Stabilizing transformer	ТС-1А	1	1
Selenium rectifier	ВС-25-8	1	1
Coupler connection	ШР28Г16ЭГ5	1	1
Coupler connection	Ш Р28П2 ЭШ7	1	1
Resistor , 400 ohms	ПО -10	1	1
Resistor , 10 ohms	РП 0-25	-	1
Resistor , 15 ohms	РП 0-25	1	-
Resistor , 500 ohms	РП 0-25	1	1
Rheostat	РС-4	-	1
Filter capacitor, 10 mfd	МБГП-1-160-10-II	2	2
Filter capacitor,0.25mfd	КБП-С-110-40-0.25-III	1	1
Stabilizing capacitor,1mfd	МБГП-3-160-1-II	1	1
Stabilizing capacitor,0.25mfd	МБГП3-400-0.25-II	1	1
Change-over switch	П	-	1

Construction of the Principal Units of the Inverter Control Boxes

Starting Contactors

For remote control of the starting and disconnection of type MA-100M and MA-250M units, type K-50A contactors are used / Fig.16/.

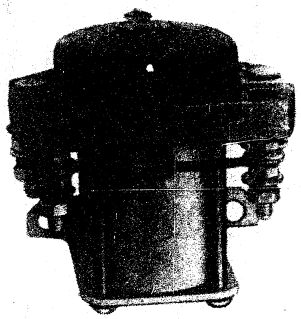


Fig. 16. External view of type K-50A contactor.

The main characteristics of these contactors are listed below in Table 8.

Table 8

Main Characteristics of the K-50A Contactor

Characteristic	Value
Rated voltage	27 V
Range of change in voltage	20 to 30 V
Rated load current of contacts	50 A
Closing voltage , in cold condition	not over 13 V

Characteristic	Value
Opening voltage , in cold condition	4 V
Closing voltage , in hot condition	not over 18 V
Opening voltage, in hot condition	5 V
Rated contactor-coil current	0.45 A
Contact pressure	not under 0.72 kg
Weight	not over 0.37 kg

The winding data of the K-50П contactor is given below in Table 9.

TABLE 9

Winding Data of K-50П Contactor

Description	Value
Grade of wire	ПЭВ-1
Diameter of bare wire , mm	0.27
Diameter over insulation , mm	0.31
Number of turns in coil	2750
Resistance of winding at 20°C , ohms	55 to 65

These contactors comprise a contact assembly operated by an integrally mounted draw-in type of electromagnet designed with a closed magnetic circuit .

The contact assembly has four contacts , two of them arranged on fixed contact terminal buses 6 and two contacts carried by movable contact bridge 5. The movable contact bridge is mechanically connected to the armature of the electromagnet .

At the terminals of the fixed contact terminal buses 6, the contact assembly is connected to the electrical load circuits. Coil 2 of the electromagnet is connected to the control circuit by means of terminals 1.

The application of a voltage to terminals 1 of contactor coil 2 sets up a magnetic flux which causes armature 3 to be drawn up against core pole projection 4 with simultaneous subsequent travel of contact bridge 5. This brings the bridge contacts down upon the two fixed contacts on fixed terminal buses 6 for closing of the load circuit.

The process of closing takes place in the following way :

At the first instant of application of the voltage to coil 2 , the air gap between armature 3 and fixed core pole 4 begins to decrease and return spring 7 undergoes compression . At the same time , the air gap between the movable contacts on bridge 5 and the fixed contacts on terminal buses 6 also decreases. When the bridge contacts meet the fixed contacts , buffer spring 8 begins to experience compression which acts to set up a pressure between the contacts,

The magnetic air gap continues to decrease and, after seating of the armature upin the core pole , further compression of the spring ceases with the pressure between contacts at a maximum .

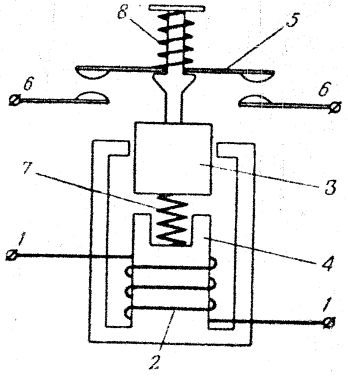


Fig.17. Schematic view of the K-50 Π_4 contactor

1- Coil terminals ; 2- Coil ; 3 - Armature; 4- Core pole; 5- Movable contact bridge ; 6- Fixed contact terminal bus; 7 - Return spring ; 8- Buffer spring .

Removal of the voltage causes the magnetic flux to disappear and the armature , together with the movable bridge , are forced back into their original positions by the return spring , and the contacts separate . On separation of the contacts , a double break of the circuit takes place . This increases the reliability of operation of these contactors . Decrease in value of the voltage applied to the terminals of the coil to an " opening " voltage / see Table 8 / results in weakening of the magnetic field to such a degree that the tractive effort of the field upon the armature is less than the force

exerted by the return spring. Because of this , the armature is returned by the spring to its original open position and the load circuit is broken.

The contact assembly consists of a panel 12, fixed-contact terminal buses 19 , movable contact bridge 9 and cover 4. Panel 12 is made of moulded , bakelite-varnish impregnated cloth insulation . The upper part of the panel has a longitudinal slot with five through holes to receives the festenings of the fixed-contact terminal buses 19 and for passage of spindle 7 through the panel. Four steel pressed-in nuts are provided in the panel and into which strain screws 21 are threaded for fastening of various parts of the contactor . Two steel posts 10 are riveted down in the panel and threaded on the ends for attachment of cover 4. They also serve as guide pins for guide plate 11 which is designed to limit the side play of movable contact bridge 9.

Fixed-contact terminal buses 19 are made of rectangular- section copper . At one end of the bus a spherical shaped silver-cadmium contact is soldered ; on the other end a brass bolt is furnished . It serves for fastening of the bus strip to the panel with the aid of nuts 30 and washers 33 and 34, and, at the same time , serves as a terminal for connection to the load circuit . In addition , the terminal buses are secured to the panel by means of rivets.

Movable contact bridge 9 is also made of rectangular-section copper. The spherically - shaped silver-cadmium contacts , with the aid of which bridge 9 closes the load circuit through the fixed contacts , are soldered on the ends of the bridge strip . The movable contact bridge is centered by slipping it on insulating bushing 5 and clamping it between the shoulders of the bushing and guide plate 11.

The electromagnetic system of the contactor consists of frame 25 and coil 18, armature 16, support 22 with pole piece 23, collar 13, return spring 28, buffer spring 14 and spindle 7. The frame , armature , pole piece , support and the collar comprise the magnetic circuit. Frame 25 is made in the form of a thin-walled steel cylinder with a half-round slot for a rubber bushing through which the coil leads are run. Coil 18 is bobbin-shapped wound of enamalled copper wire on a coil form consisting of brass sleeve 17 , steel collar 13 and two textolite insulating washers 24 , one of which is cemented to the steel collar , the second washer being cemented to the shoulder of the sleeve. The sleeve , itself , is expanded into collar 13 and its external surface is covered with insulation. The coil leads , of flexible insulated wire, are passed through the rubber bushing and fitted with brass pistons by means of which the leads are attached to the terminals . The external parts of the coil , as the sleeve, are provided with insulation, and the coil is fastened within the frame, The free space between the frame and the coil winding is then filled with a heat-conducting insulating compound .

Sliding armature 16 is made in the form of a steel cylinder with a hole through its entire length. Support 22 is of sheet steel and, on the wall which is bent at a right angle to the base , has two holes which serve for installation of the contactor. Stiffening ribs for increased rigidity have been stamped in the corners of the support. Steel pole piece 23, made in the form of a cylinder with a blind bore , is fastened to the base part of the support .

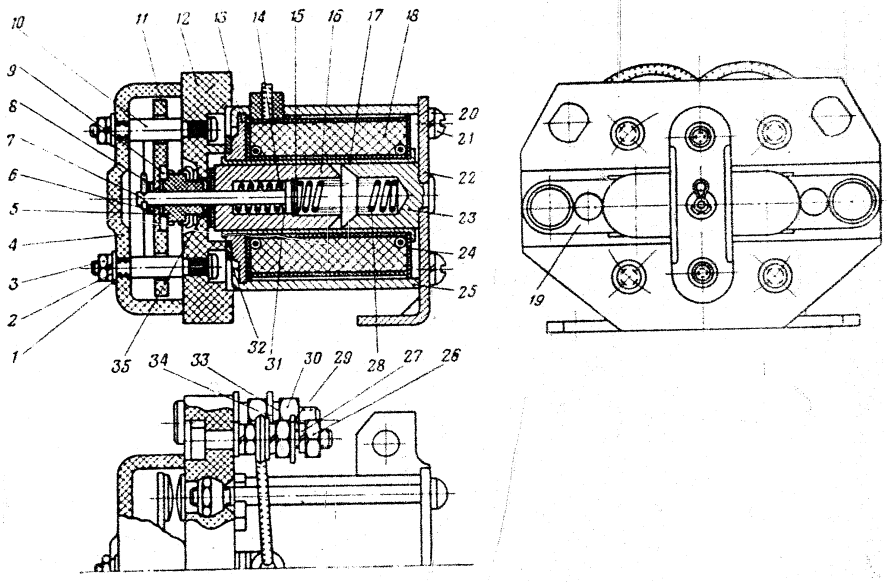


Fig.18. Sectional view of K-50 contactor
1- Washer; 2- Spring washer; 3- Nut; 4- Cover; 5- Bushing; 6- Washer; 7- Spindle; 8- Cotter pin; 9- Movable contact bridge; 10- Guide posts; 11- Guide plate; 12- Panel; 13- Collar; 14- Buffer spring; 15- Washer; 16- Armature; 17-Sleeve; 18- Coil winding; 19- Fixed-contact terminal bus; 20- Spring washer; 21-Screw; 22- Support; 23- Pole piece; 24- Washer ; 25- Frame; 26- Nut; 27- Spring washer; 28- Return spring; 29- Washer; 30-Nut; 31- Washer ; 32- Washer; 33- Spring washer; 34- Washer; 35-Washer.

Four holes provided in the base of the support serve for passage of screws 21. Return spring 28 serves to return the moving system of the contactor to the open position on breaking of the circuit . Buffer spring 14 is used to set up a pressure between the moving and fixed contacts when the contactor is closed . Both the return and buffer springs are helically wound of round steel wire . The return spring is arranged in the bores of armature 16 and pole piece 23 where one end presses up against the bottom of the bore in the pole piece and the other end presses against washer 15 which , in turn , rests on a recess in the sliding armature. The return spring is in a compressed condition and the force it exerts upon the armature is adjusted by means of washers 15. Buffer spring 14 is also arranged in the bore of the armature where one end is pressed against a shoulder of the bore and the other end is pressed up against the head of spindle 7. The buffer spring is also under compression , the value of which is adjusted by aid of washers 31. On the steel spindle 7, which is made in the form of a round rod with a flat head, the entire moving system of the contactor is assembled . The spindle is passed through buffer spring 14, sliding armature 16, insulating bushing 5 , and insulating guide plate 11, and is fastened with the aid of washer 6 and cotter pin 8.

Cover 4 serves to protect the contact assembly and is also manufactured , as panel 12, from moulded bakelite - impregnated cloth .

Carbon-Pile Voltage Regulator

In the circuits of type MA-100M and MA-250M units ,type РУГ-3М carbon-pile voltage regulators are employed .

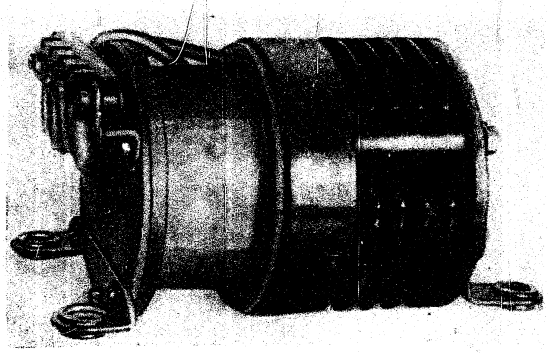


Fig. 19. External view of the РУГ-3М Voltage Regulator

The РУГ-3М voltage regulator is an automatic device with a carbon-pile, smoothly-variable resistance and is designed to regulate the output voltage of the inverter unit within fixed limits , on changes in load and speed of rotation , in accordance with the rating of the inverter unit .

These carbon-pile voltage regulators consist of two main elements :

1. An electromagnet which responds to changes in the output voltage / through a selenium rectifier / -- this is the voltage-sensing element of the voltage regulator .

2. A carbon-pile , the change in resistance of which controls the change in exciting current in the generator field winding and by means of which the output voltage is kept constant / the final control element /.

The electromagnet acts upon the carbon pile by means of an armature mechanically connected to a set of flat springs.

A simplified diagram of the connections between the voltage regulator end the inverter is given in Fig.20 /also see Fig.3/.

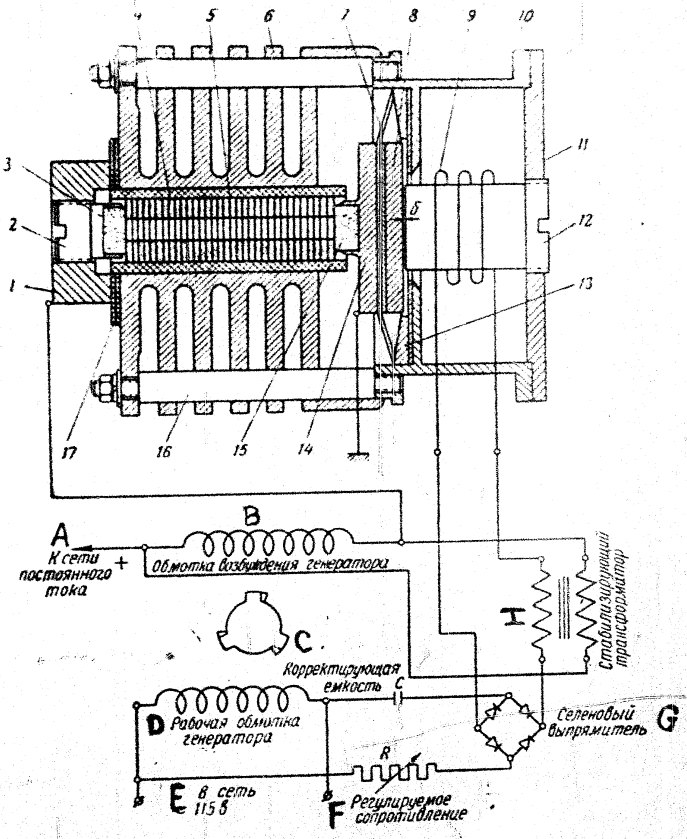


Fig.20. Simplified circuit diagram of carbon-pile voltage regulator

A- To d.c. circuit; B- Generator field winding; C-Correction capacitance; D - Working or main winding of generator; E- To 115 V a.c. circuit ; F- Adjusting resistance; G-Selenium rectifier ; H- Stabilizing transformer. 1- Flange; 2- Adjusting screw; 3- Carbon contact; 4- Carbon pile; 5- Tube ; 6 - Body; 7 - Spring ; 8 - Armature; 9-Winding ; 10- Frame of electromagnet ; 11 - Cover ; 12 - Core ; 13 - Ring; 14 - Holder ; 15 - Carbon contact ; 16 - Post stud; 17 - Gasket .

Winding 9 of the electromagnet , arranged in frame 10, is connected , through the stabilizing transformer ,selenium rectifier, adjusting resistance and the correction capacitance, in parallel with the working or main winding of the generator.

Core 12 of the electromagnet,at its threaded end, is fastened to cover 11. By threading the core inward or outward , air gap δ between the core face and armature 8 can be adjusted as required . The attraction of the armature to the core is resisted by flat spring 7, rigidly secured to the armature and pressing up against conical diamagnetic ring 13 which is arranged inside the electromagnet frame.

Holder 14, in which carbon contact 15 is pressed,is arranged on the armature . Carbon pile 4, type MAP-11,consisting of a set of carbon discs enclosed in ceramic insulating sleeve 5 is mounted inside finned body 6. The electromagnet frame 10 and finned body are joined togather by means of three steel post studs 16. One end of the carbon pile is thrust up against carbon contact 15 on the armature ; the other end of the carbon pile is thrust up against carbon contact 3 which is pressed into adjusting screw 2. The adjusting screw , in turn , is threaded into flange 1, fastened on the finned body with the aid of screws .

The flange is insulated from the body by mica gaskets 17. When adjusting screw 2 is screwed into flange 1, the carbon pile is compressed between carbon contacts 3 and 15, experiencing the pressure set up by the armature springs as they are caused to bend. The carbon pile under such conditions represents a resistance , the value of which changes with changes in the pressure set up by the armature of the electromagnet .

The carbon pile is connected in series with the field winding of the inverter unit generator. At a definite value of exciting current in the winding , which is dependent upon the output voltage of the inverter , the tractive force set up by the electromagnet completely balances the force developed by the spring at any position of the armature and, consequently, the armature can also stay without motion in any position. Should the current in the coil of the electromagnet exceed a definite value , the forces developed by the electromagnet will exceed the force exerted by the spring , the armature will be attracted towards the core , and the resistance of the carbon pile will rise. At a value of current less than a certain critical value , the armature is forced away from the core by the action of the spring and the resistance of the carbon pile is decreased. Thus , any change in current in the winding of the electromagnet causes the armature to take up a new position which ensures attainment of a necessary change in current in the field winding of the generator sufficient for maintaining the output voltage of the inverter unit at a definite level in accordance with the adjustments made.

The moving element of the voltage regulator , as stated above , is the armature of the electromagnet, which is under the action of three main forces ; the forces exerted by the armature springs when subjected to deformation , the resultive tractive forces of the electromagnet and the elastic reactive forces of the carbon pile. The armature is in a state of equilibrium as long as the algebraic sum of these three forces is equal to zero. On disturbance of the balance of these forces , the armature is caused to shift , either increasing or decreasing the air gap between the armature and the core of the electromagnet until a new position at which the forces are balanced is reached . The tractive effort of the electromagnet depends upon the number of ampere turns of its winding which is proportional to the voltage of the working winding of the inverter unit generator . If the voltage of the inverter unit generator is considerably below its rated value, or is equal to zero , the air gap between the armature and the core is at a maximum value and the force exerted by the armature springs upon the carbon pile is also of maximum value. Under these conditions the resistance of the pile is very low.

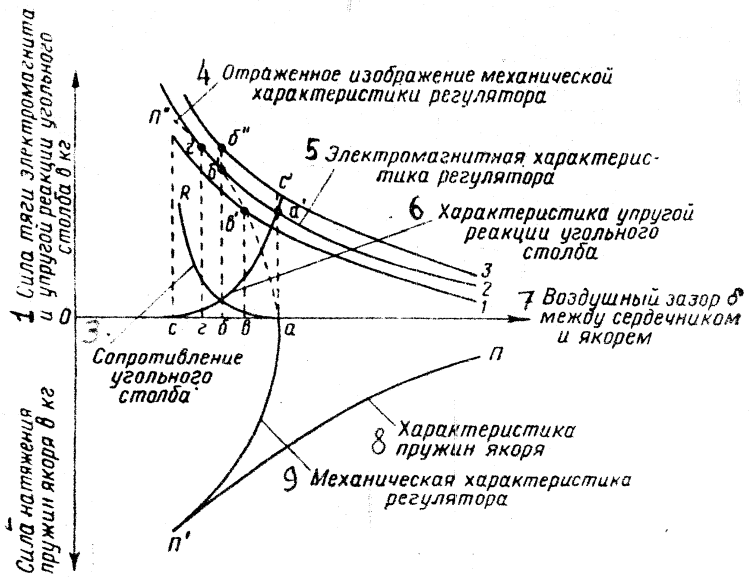


Fig.21. Interaction of the forces acting upon the armature of the carbon-pile voltage regulator.

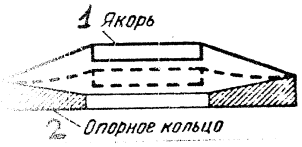
1. Tractive effort of electromagnet and elastic reactive force of carbon pile, kg. 2. Forces due to deformation of armature springs, kg. 3. Carbon-pile resistance; 4. Image of mechanical characteristic of the regulator. 5. Electromagnetic characteristic of the regulator. 6. Elastic reaction characteristic of the carbon pile. 7. Air gap δ between the core and the armature. 8. Armature springs characteristic. 9. Mechanical characteristic of the regulator.

By matching the electromagnetic characteristic / dependence of the tractive effort of the electromagnet upon the air gap between the armature and core/ and the mechanical characteristic / dependence of the resultant force upon the value of the above air gap -- this resultant being the difference between the forces due to the elastic deformation of the carbon pile and the forces set up by the armature springs/

s attained the necessary change in carbon pile resistance
t which the voltage of the inverter generator approaches a
ixed value.

In the upper part of the graph , curves 1,2 and 3 show the tractive effort of the electromagnet plotted as a function of air gap δ between the armature and the core at rated value of voltage / curve 2/ and also at the upper /curve 3/ and lower /curve 1/ limits of rated voltage. As can be seen in Fig. 21 , the tractive effort of the electromagnet increases with a decrease in air gap and with a rise in work-ing voltage . The character of the voltage regulation depends to the degree to which the electromagnetic characteristic coincides with the mechanical characteristic. The characteristic of the elastic-deformation forces / reaction / of the carbon pile is plotted as curve cc' in the upper part of the graph, the characteristic of the armature spring forces being plotted as curve II II' in the lower part of the graph. The mechanical characteristic of the regulator itself is plotted as curve aII'. For comparison of the characteristics of the regulator / for convenience of comparison the mechanical characteristic is plotted in the upper part of the graph as dotted curve aII"/it may be seen that points a and c are the boundaries of change of air gap or armature travel during the operation of the regulator . The electromagnetic and mechanical characteristics coincide over only a limited section of the available regula-ting-armature travel.

It is namely within these limits that the maximum change
carbon pile resistance takes place. Under normal conditions,
armature-spring characteristic is nearly rectilinear. To
ke the spring mechanical characteristic approach the electro-
netic characteristic of the regulator , the support ring
made with a conical face, thanks to which the active length
the spring , on deformation , decreases as the points of
port on the ring shift concentrically / Fig.22/. The electro-
netic characteristic of the regulator shifts upward or down-
ward depending upon the value
of the voltage of the inverter -
unit generator working winding .
When the inverter is not in ope-
ration, the armature of the regu-
lator is at point a, since the
tractive effort of the electro-
magnet and and the resultant mecha-
nical force are equal to zero.



Shifting of points
of support of arma-
ture springs over
support ring.
rmature; 2.supporting ring.

When the inverter unit is in operation , as the
ge rises in value , the tractive effort of the electro-
et increases , the armature moves from point a to point c,
the air gap between the armature and core decreases. The
ement of the armature is dependent upon the interaction of

the mechanical and electromagnetic forces. The mechanical force which causes armature movement varies in accordance with the mechanical characteristic of the regulator, while the " electromagnetic" effort changes in accordance with the electromagnetic characteristic particular to the voltage regulator at the voltage developed by the unit at the moment in question . Thus, for example , if the voltage rises to [illegible] V / intermediate curve/, the armature of the regulator cannot remain in its original position , because , at an air gap of Oa , the tractive effort of the electromagnet is equal to zero and the mechanical force is equal to zero. This results in movement of the armature towards the core. This movement continues until the tractive effort of the electromagnet is balanced by the resistive mechanical forces . As may be seen in [illegible] , the position of equilibrium corresponds to an air gap of 0б ; and the mechanical and electromagnetic characteristics of the regulator meet at point " . .

At intermediate points between a and б the armature will occupy positions which correspond to the point of intersection of the mechanical and electromagnetic characteristics . For example , at the lower limit of the output voltage/curve 1/ the air gap will be equal to 0б .

A seen on resistance curve aR , a change in air gap from a to б has relatively little effect upon the value of the carbon-pile resistance. Further movement of the armature , however , leads to considerable change in resistance of the carbon pile. Beginning with the moment at which the voltage of the generator reaches a set values , for example 115 volts,

[redacted]

, voltage regulator begins to operate . If it be assumed
t the armature is in a position corresponding to point
and the generator voltage suddenly shoots upward; for
mple , because of loss of the load , the tractive effort
e electromagnet increases by a valve equal to $\delta' \delta$ and
mature begins to move towards the core .

movement of the armature is accompanied by an
in carbon-pile resistance , and , consequently, by
se in voltage . Armature travel takes place until the
effort of the electromagnet , the value of which
together with the fall in voltage , becomes equal
hanical forces acting upon the armature . When the
and electromagnetic characteristics of the voltage
coincide , equilibrium is reached at a voltage of
the armature taking up a new position of balance
responds to the air gap 0_2 .

sary matching of the mechanical and electro-
acteristics within the limits of their working
complished in the process of assembly of the regula-
ging the core end face of the electromagnet in one
the end face of the electromagnet body which faces
core , and also by adjusting the seating of the armature
support ring for a definite air gap between its end
the face of the core at a definite value of pressure
upon the armature .

Adjustments of the air gap between the core face and armature are made with the aid of spacing gaskets 17. Final
ching of the characteristics and adjustments for ensuring

a regulation of the output voltage within set limits is accomplished by adjusting screw 2 and its carbon contact. When the screw is threaded inward , beginning from a position at which the carbon pile is completely free from pressure , the output voltage of the inverter unit will vary in accordance with the curve given in Fig.23. This curve shows that during the first period of inward movement of the adjusting carbon contact / starting from a position where the pile is completely free of pressure and up to point A /, the voltage slowly increases / clearances between the carbon discs being taken up/. Beyond point A the voltage sharply rises , reaching its maximum at point B . Beginning with point B the regulator becomes unstable because the spring begins to vibrate and causes sharp oscillations of the output voltage . The amplitude of spring oscillation may reach such values that full contact between the carbon discs of the pile is disturbed , as a result of which arcs are set up between the discs , capable of burning and also damaging them. On further movement of the screw towards point B, vibration of the spring ceases and the regulator becomes stable in operation. Section B Γ on the curve corresponds to stable operation of the regulator . If inward movement of the screw is continued , the pile becomes fully compressed , its resistance is a minimum and regulation of the voltage ceases. The most satisfactory matching of the characteristics / mechanical and electromagnetic / is attained on the stable operation section B Γ.

The working point on the B Γ section of the curve is located somewhat away from the midway point in the direction of point Γ.

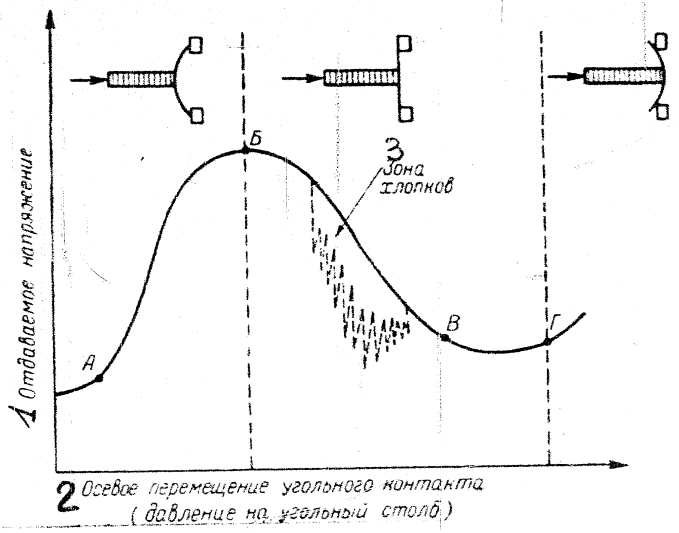


Fig.23. Dependence of inverter-unit output voltage upon position of adjusting screw during adjustment of voltage regulator .

1. Output voltage. 2. Axial displacement of carbon contact / pressure on carbon pile/. 3 . Sparky-operation / noisy/ zone.

Operation of the carbon pile regulator is accompanied by liberation of considerable heat in the carbon pile which may lead to disturbance of the main perameters of the regulator because of changes in the linear dimensions of its various units and parts , and may also lead to accelerated rates of wear of the carbon pile discs. With the aim of reducing the detrimental effects of the heat liberated in the carbon pile, the regulator is designed with :

1. A body / of an aluminium alloy/ with a developed finned surface in which the carbon pile is assembled for effective transfer of heat to the surrounding atmosphere .

2. The control box and its hood or cover are provided with louvers .

The body of the РУТ-8М regulator in which the carbon pile is enclosed is attached to the body of the electromagnet by means of three steel post studs the length of which,due to the low temperature coefficient of expansion of the steel , changes to such a small degree under changes in temperature that it has practically no influence upon carbon pile operat-

The carbon pile voltage regulator consists of the following main parts and assemblies : electromagnet frame assembly 10, armature assembly 8, diamagnetic support ring 13, carbon pile 4 , ceramic insulating tube 5, carbon-pile body 6, voltage 1 for fastening of the adjusting screw with the contact, and three post studs 16 connecting the electromagnetic frame to the carbon-pile body.

The electromagnet frame assembly includes frame 10, cover 11, and core 12 which make up the magnetic circuit, and coil 9.

The electromagnet frame is made in the form of a sleeve of electrotechnical steel. A hole is provided in the bottom for core 12, and the outside face of the bottom is made for the diamagnetic support ring 13 and the spacing ring. Holes for bringing out the leads are also provided in the bottom. Cover 11 is designed in the form of a washer plate with a shoulder for centering it on the frame. Core 12 is made of electrotechnical steel and has a cylindrical shape and is threaded at one end. The threaded end is screwed into the bottom of the regulator. For conveenience of adjusting of the gap when setting up the regulator, the end face of the core has a slot for the use of a screw-driver.

Coil 9 of the electromagnet is of cylindrical shape and is arranged on a coil form with a brass sleeve and textolite washers.

The winding data of the coil is given in Table 10.

TABLE 10.

Winding Data of Voltage Regulator Coil

Description	Type of Regulator РУТ-3М
Make of wire	ПЭЛ
Diameter of bare wire, mm	0.29
Diameter over insulation of wire, mm	0.33
Number of turns	3000
Resistance of coil at 20°C, ohms	86±8

The coil is arranged within the frame , bearing against the bottom . At the opposite end it is pressed down by the cover. The clearance between the coil and the cover is taken up by washers of electrical pressboard.

Armature assembly 8 is built up of several parts, the main ones of which are : the armature proper, made of electro-technical steel , six plate springs , washers and screws for attachment of the armature parts , and the contact holder with its pressed-in carbon contact. In the regulator , the group of springs consists of three steel strips bent to a definite angle. Thin brass spacers are arranged between the springs , thanks to which the strength of the connections between the springs is increased and turning of the springs is excluded. The holder is insulated from the armature by mica shims ; the screws being insulated by mica washers and ceramic bushings .

Connection of the armature contact to the external circuit is accomplished by means of a flexible lead soldered to the cable connector fastened on the holder.

Ceramic tube 6 is secured within the body by a screw and a clamping strip which enters and presses against a slot in the tube.

Flange 1, with adjusting screw 2, is fastened on the end of the body with the aid of screws. Since the flange acts as a current-conducting member , it is insulated from the body by means of mica spacers ; the screw , in turn , are insulated with mica washers and ceramic bushings .

After adjustments of the carbon-pile regulator have been made, the adjusting screw and its contact are fixed in the set point by compressing the upper slotted part of the flange .

Terminal leads from the carbon pile and the coil are brought out on a special moulded plastics terminal panel 18, fastened on the end of the body with the aid of screws and bracket straps.

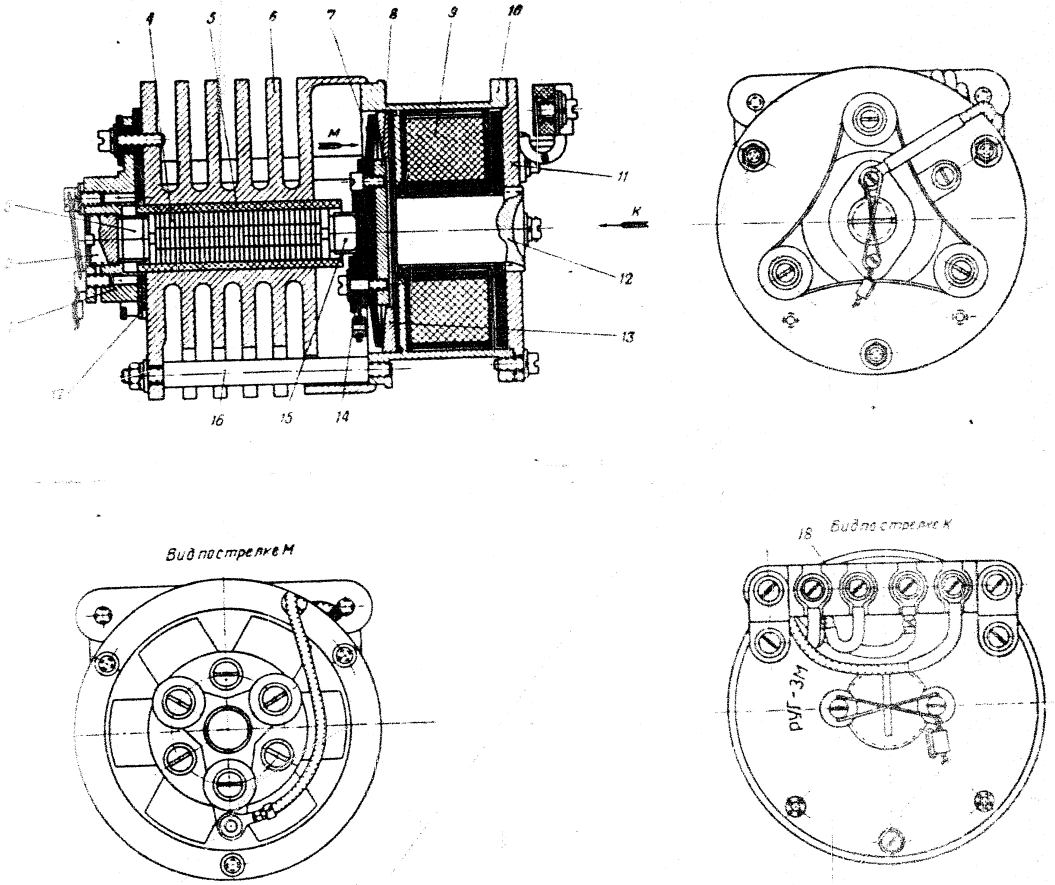


Fig.24. РУТ-3М voltage regulator / without supports /

A- View along arrow M. B- View along arrow K.
1 - Flange; 2 - Adjusting screw; 3 - Carbon contact ; 4 -Carbon pile; 5 - Insulating tube ; 6 - Body; 7 -Springs ; 8-Armature; 9- Coil ; 10 - Frame of electromagnet ; 11- Cover ; 12-Core; 13- Diamagnetic ring; 14 - Holder ; 15 - Carbon contact ; 16- Post stud; 17- Gasket ; 18- Terminal panel .

These regulators are fastened on supports provided with shock-absorbing springs.

The technical characteristics of these regulators are given in Table 11 below.

TABLE 11

Voltage Regulator Characteristics

Type of inverter unit in which the voltage regulator is used	Type of voltage regulator	Resistance of carbon pile on changes in supply voltage from 24.3 to 29.7volts, in ohms		Maximum power load of pile, W	Current rating of working winding, A
		not less than	not over than		
MA - 100M	РУГ-3М	5	50	65	0.17-0.175
MA - 250M	РУГ-3М	3	50	65	0.17-0.175

The values of carbon pile resistance given above are those required for regulation of the voltage. They ensure stable regulator operation at the given values of current over a range of change in supply voltage between 24.3 and 29.7volts.

Stabilizing Transformers

To increase the stability of operation of the regulators during transient processes , and to reduce the time of the transient processes , the control boxes are equipped with stabilizing transformers .

primary winding leads H_1 / beginning - Начало/ -red; and K_1 / end - Конец/ - green

secondary winding leads H_2 / beginning / - black ; and K_2 / end/ - white .

The wound and insulated coil is slipped over round core 4 , made electrotechnical steel and expanded at the top after assembly with clip 2 ,also made of electrotechnical steel. At the bottom , the core is threaded for fastening of the transformer inside the inverter unit control box.

The technical characteristics the transformer are given in Table 12.

TABLE 12

Principal Characteristics of the Transformer

Characteristic	Value
Rated voltage , V	20±10%
No-load current , A	0.036
Ratio of transformation	0.13

The winding data of the transformer coils is listed in Table 13 .

TABLE 13

Transformer Winding Data

Description	Value
Primary Winding	
Grade of wire	ПЭЛ
Diameter of bare wire , mm	0.1
Diameter over insulation of wire , mm	0.12
Number of turns	3000
Resistance of winding at 20°C, ohms	330 to 402

/ Continuation/

Description	Value
Secondary Winding	
Grade of wire	ПЭЛ
Diameter of bare wire , mm	0.25
Diameter over insulation of wire , mm	0.275
Number of turns	800
Resistence of winding at 20°C, ohms	9.8-12

Selenium Rectifier

Type BC-25-8 / Fig.27/ selenium rectifiers are used in the control boxes of both types of the inverter units.The BC-25-8 selenium rectifiers are employed for the rectification of alternating currents of up to 500 cycle frequency .

The normal operating position of the rectifier is the horizontal position .

As to design , the selenium rectifier / Fig. 28 / comprises a set of separate elements / valves / assembled on

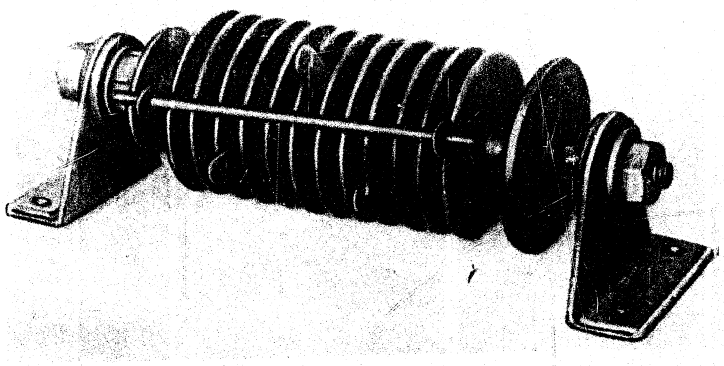


Fig. 27 . External view of the BC-25-8 Selenium Rectifier

/ Continuation/

Description	Value
Secondary Winding	
Grade of wire	ПЭЛ
Diameter of bare wire , mm	0.25
Diameter over insulation of wire , mm	0.275
Number of turns	800
Resistance of winding at 20°C, ohms	9.8-12

Selenium Rectifier

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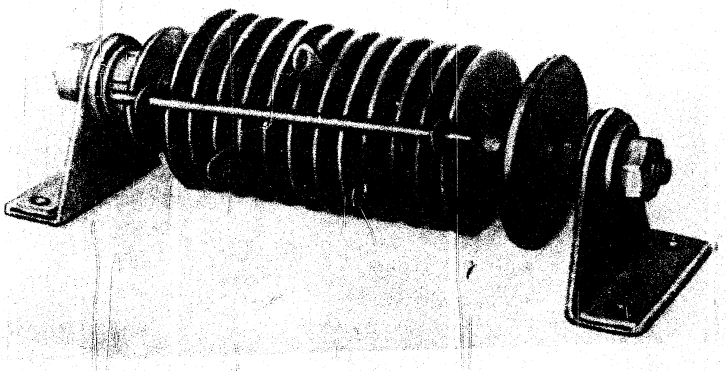


Fig. 27 . External view of the BC-25-8 Selenium Rectifier

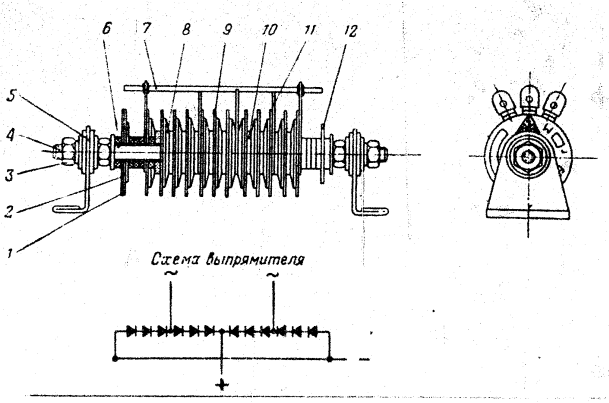


Fig.28. BC-25-8 Selenium Rectifier

1- Insulating washer; 2- Name plate; 3- Nut; 4 - Rod ; 5- Support ; 6 - Insulating washer ; 7 - Jumper ; 8 -Contact washer ; 9 - Disc; 10- Spacing washer ; 11- Tap ; 12-Insulating washer . A- Rectifier circuit

insulated rod 4 . The base of the selenium valve element is a thin nickel-plated steel disc 9 coated on one side with a layer of selenium on which a thin layer of cadmium-tin alloy is applied / sprayed on / and which acts as the cathode of the valve element. In order to avoid short circuiting between the metal alloy coating and the steel disc , the alloy is sprayed on in the form of a ring, the outer diameter of which is somewhat smaller than the diameter of the disc , and the inside diameter of which is greater than the diameter of the hole.The ring area corresponds to the active surface of the selenium

valve. On passage of a current from the selenium towards the cathode, the valve presents a low resistance /direct/; flow of current in the opposite direction experiences a high resistance / back-flow/ . The rectifying effect of the selenium valve is produced by the large change in electrical resistance of the thin boundry film of the selenium valve / blocking layer/ when the direction of flow of the current through the valve changes. When the valve elements are connected in series , the voltage to be rectified can be increased to a desired value. The ring on the " selenium"disc 9 is kept under the pressure of a hard-drawn brass , contact spring washer 8. In addition to this , metal spacer washers 10 are employed between the separate valves.

The total length of the selenium rectifier is held to set dimensions by the use of insulating washers 6 and the extreme valve taps are connected together by jumper 7.

End insulating washers 1 and 12 , are fitted on the ends of the rod. The name plate bearing the type designation of the rectifier is also installed on one end of the rod.

For installation of the rectifier within the control box , two supports 5 are fastened on the rod by means of nuts 3.

To protect the selenium valve elements against atmospheric moisture , their external surfaces are coated with paint.

Technical characteristics of BC-25-8 Selenium Rectifiers

Diameter of stack ..... 25 mm

Applied voltage .....54 V

Rectified voltage . . . . . not less than 39 V

Rated load current ,..... 0.15 A

Value of drop in voltage across one valve element . . . . . not over 1.2 V

Filter Components

Inverter unit filters comprise a set of chokes and capacitors .

External views of the chokes used in the various inverter units may be seen in Fig.29.

These chokes consist of ring cores toroid wound with flexible wire which has been preliminarily insulated with a half-lap serving of cotton tape . To make the choke more monolithic , it is impregnated with an insulating varnish after making the winding .

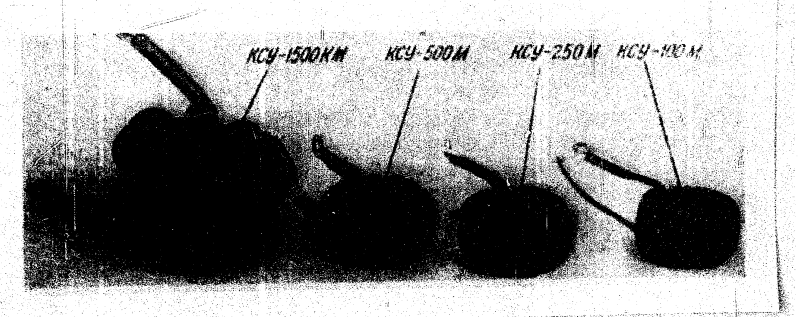


Fig. 29 . External view of the filter chokes

For higher values of self-inductance , the ring cores are made of alsifer. Fastening of the chokes in the control box is accomplished by means of screws and special insulating bushings .

Winding data of the chokes is given in Table 14.

TABLE 14

Winding Data of the Chokes

Description	Type of Inverter Unit	
	MA-100M	MA-250M
Grade of wire	МГШЛ ОЛК	БПВЛ
Wire size . mm^2	2.5	4
Number of turns	28	21

Capacitors of the following types are employed in the filters : МБГП-1-160-10-11 and МБГП-1-200-10-11, each of 10 mfd capacitance , КСП-С-110-40-0.25-III of 0.25 mfd capacitance , and КБП-С-110-20-0.1-II of 0.1 mfd capacitance .

External views of the capacitors may be seen in Fig.30.

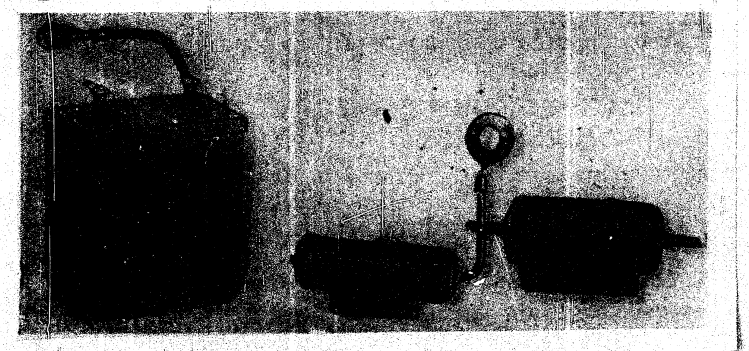


Fig. 30. External views of the filter capacitors .

Vitreous-Enamalled Resistors

For possibility of adjusting the inverter unit parameters , the circuit of the control box employs vitreous-enamalled wire wound resistors of two types with different values of resistance / Fig. 31/ , namely : typeПО-fixed wire wound resistor , and type ПО-25 -- variable wire wound resistor. These resistors are wound with high resistance constantan or nickel-chromium wire on ceramic tubes which are given a protective vitreous-enamal coating and are supplied at the ends with rigid leads for connection to the circuit.

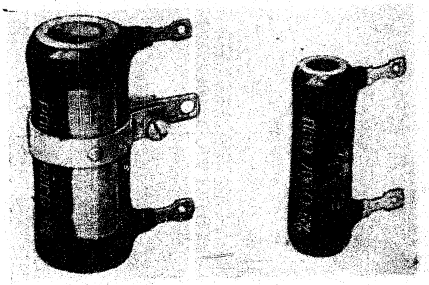


Fig. 31. Vitreous-enamalled resistors

Type ПО - 25 resistors have a longitudinal bared-wire section and a third tap in the form of a movable strap clamp. These resistors are mounted with the aid of studs passed through the tube. Mountings made by fastening the resistor only at the leads / suspended/ or by means of an external strap are not allowed . The resistors used for each type of inverter unit are listed in Table 7 .

YI. Circuit Connections and Principle of Operation of the Inverters

All elements of the inverter units are connected together in accordance with the elementary circuit diagrams given in Figs.32 and 33. Remote starting of a unit is accomplished from a control board with the aid of a single-pole knife switch .

On closing of the knife switch , closing of the starting or closing coil circuit of contactor K_1 takes place and contactor K_1 closes to apply the voltage to the motor. The voltage , in addition , is transfered through the coupler receptacle terminals to the necessary loads and to the field winding of the generator . At the instant of starting of the motor , the series field CO and the shunt winding WO are simultaneously excited . The use of the series coil limits the rush of starting current and increases the starting torque of the inverter unit.

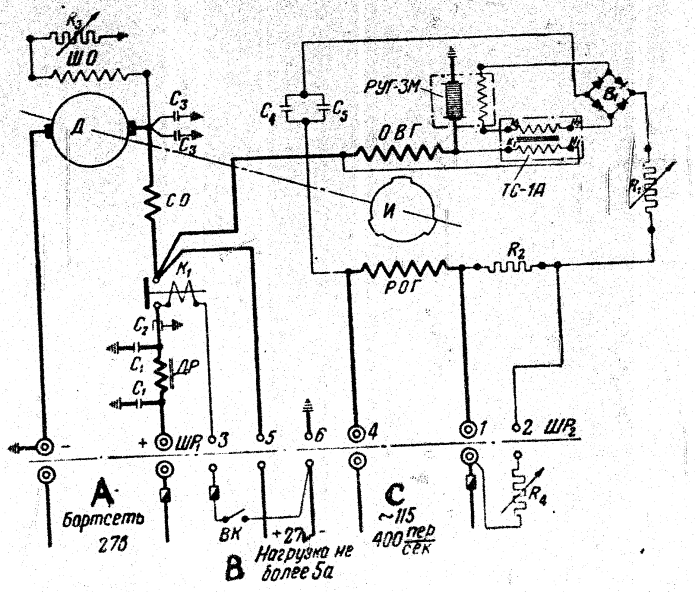


Fig.32. Elementary circuit diagram of the type MA-100M inverter unit

A -- Aircraft supply circuit 27 V. B -- Load not over 5 amp. C -- 400 cycles/sec. D -- 8 = V.

Variable resistor R_3 is connected in the shunt winding for making adjustments of the motor speed.

Field winding ОВГ of the generator is connected in circuit with the carbon pile of the type РУГ-3М voltage regulator. The coil of the voltage regulator is fed from the generator working winding РОГ through selenium rectifier B_1. When an increase in the generator output voltage takes place, a large current will flow through the voltage regulator coil and the electromagnetic effort of the coil will exceed the counter force of the spring to cause the pressure upon the carbon pile to decrease for an increase in resistance in the

field circuit of the generator. As a result , the generator field current falls off to thus lower the output voltage . On a drop in the output voltage, the process takes place reversed to that described above.

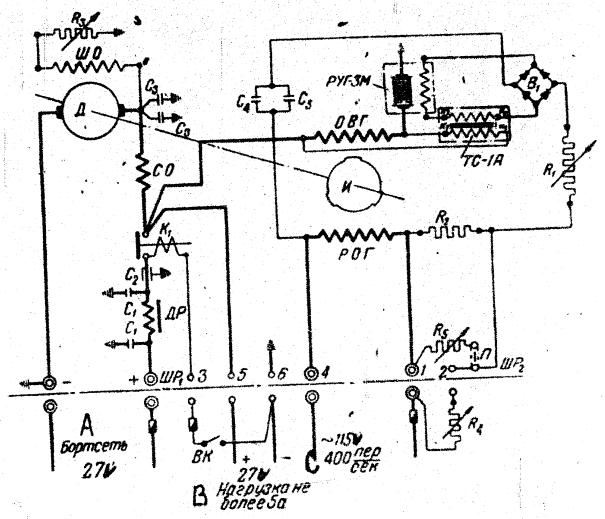


Fig. 33. Elementary circuit diagram of type MA-250M inverter unit .
A— Aircraft supply circuit , 27 V; B— Load not over 5 amp; C— 400 cycles/sec;

By the above regulation , on changes in load of from 100 to 30% , and fluctuation in supply voltage between 24.3 and 29.7 volts , an output voltage held to within 115±3.5 volts is ensured.

The selenium rectifier which feeds the voltage regulator coil is connected to the generator output voltage through a correcting / stabilizing / capacitor / in the MA-100M and MA-250M units through two capacitors C_4 and C_5 arranged in parallel/, a 500-ohm type PTO-25 resistor R_1 and a 400-ohm type TO-10 resistor R_2 , in parallel with which , in the exter-

nal circuit , a voltage-level adjusting rheostat is connected. The 500-ohm type PTIO-25 resistor R_1 serves for making the first adjustments of the level of the regulable generator voltage ; for use during operation , however , a 400-ohm voltage-level adjusting resistor R_4 is provided , which is connected to the external circuit terminals on the unit . On absence of a variable resistor in the external circuit connections of the MA-250M units , the voltage-level adjustments are accomplished with a PC-4 rheostat R_5 installed directly on the external side of the inverter control box end wall. The PC-4 rheostat is cut into the circuit by throwing change-over switch PI from the "out" / [illegible] / position into the "in" / [illegible] / position. This switch is arranged on the inner side of the inverter control box end wall. The MA-250M units are shipped from the works with the PC-4 rheostat cut out of the circuit.

Correcting capacitors employed in the voltage- regulator coil supply circuit increase the accuracy of regulation .

The capacitive reactance of the capacitors changes in accordance with the a.c. frequency of the generator. The connection of the capacitors in the circuit thus provides for the correction of the regulated voltage in dependence upon its frequency.

To ensure stable voltage regulator operation , the circuit includes a type TC-1A stabilizing transformer .

The primary winding of the stabilizing transformer is connected in parallel with the generator field winding and the secondary is connected in the circuit of the voltage-regulator coil. In its transformation , the a-c component of the voltage across the ends of the generator field winding sets

an additional current in the voltage regulator coil which ries in the process of operation of the regulator. The lectromagnetic forces produced by this current are always irected against the forces set up by the working coil of the egulator and , by smoothing out the sharp changes in resistan- of the carbon pile, decrease the fluctuation of the current n the generator field winding.

The stabilizing transformer thus functions as a buffer hich accelerates the damping of transient processes which ccur as a result of the regulation of the output voltage lso acts to lower wear in the carbon pile .

VII. Inverter Unit Characteristics

The mechanical and electrical properties of MA series nverter units are evaluated by two families of characteristic urves -- load or working characteristics and operating-condit- on characteristics .

The load or working characteristics give the values of the output voltage u_2, speed n , frequency f, supply - ircuit current I, and the efficiency η as a function of the enerator load current I_2 at a constant value of the supply oltage u_1 and a constant power factor cos φ , i.e. :

$$u_2 , n, f, I_1, \eta = f / I_2/$$

for u_1 = const. and cos φ = const .

The load characteristics may be seen in Figs. 34 and 35.

The operating-condition characteristics give the same values as a function of the applied voltage u_1 , with the generator operating at the rated load current I_2 and a constant power factor cos φ, i.e. :

$$u_2 , n, f, I_1 , \eta = f / u_1 /$$

for I_2 = const . and cos φ = const .

The operating-condition characteristics are given in Figs . 36 and 37 .

Examination of the plotted characteristics shows that in MA serier inverter units supplied with carbon pile voltage regulators the per cent change in output voltage will amount to about 5% on a change in load from zero to rated value , and a change in supply voltage within the range of 20 to 30 volts.

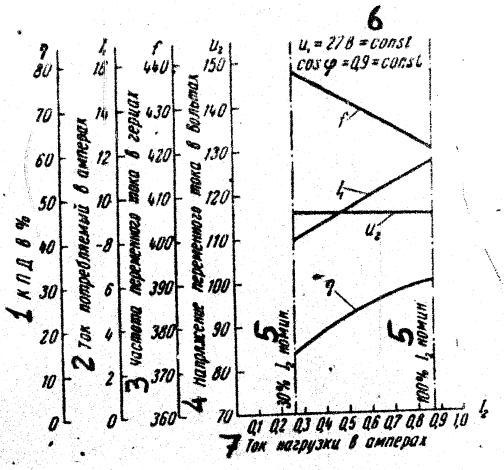
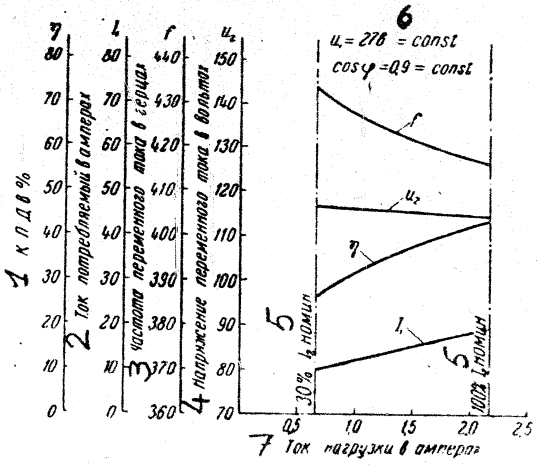


Fig.34. Load or working characteristics of the MA-100M unit. 1- Efficiency , %; 2- Supply circuit current A; 3-Frequency, cycles/sec .; 4- A-c voltage , V ; 5- I_2 nom .; 6- u_1 = =27 V = const . cos φ = 0.9 = const; 7- Load current, A.



...35. Load or working characteristics of the MA-250M unit

...fficiency, % circuit current A; 2 - Supply circuit current A;
...equency, cycles/sec .; 4 - A-c voltage , V; 5 - I_2 nom.;
... = 27 V = const. cos φ = 0.9 = const.; 7 - Load
...ent , A.

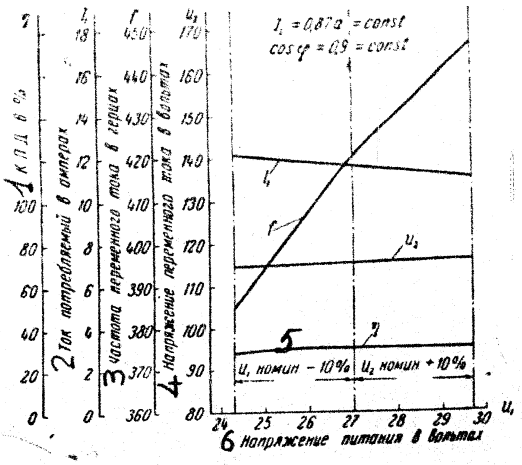
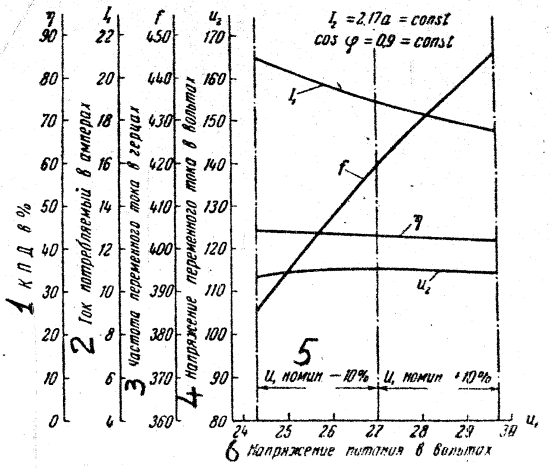


Fig. 36. Operating-condition characteristics of the MA-100M unit.
1- Efficiency ,%; 2- Supply circuit current ,A; 3-Frequency, cycles/sec.; 4 - A-c voltage , V; 5- u_1 nom. -10% | u_2 nom. + 10%; 6 - Supply voltage , V.



87. Operating - condition characteristics of the MA-250M unit.

Efficiency , %; 2- Supply circuit current ,A; 3- Frequency, ycles/sec.; 4 - A-c voltage , V; 5 - u_1 nom .; 6- Supply oltage , V .

INVERTER UNIT OPERATING INSTRUCTIONS

1. Inverter Installation

Before the unit is installed it is necessary to inspect for absence of mechanical damage which may have been ccurred during transportation or when unpacked .

The inverters are to be mounted horizontally on type 1C49 or 272C49 shock absorbers with the control box facing forward .

For the outline-erection dimensions see Figs.88 and 89. The shock absorbers protect the units against vibration and shocks , and the installation of units without the use of shock absorbers is not to be allowed.

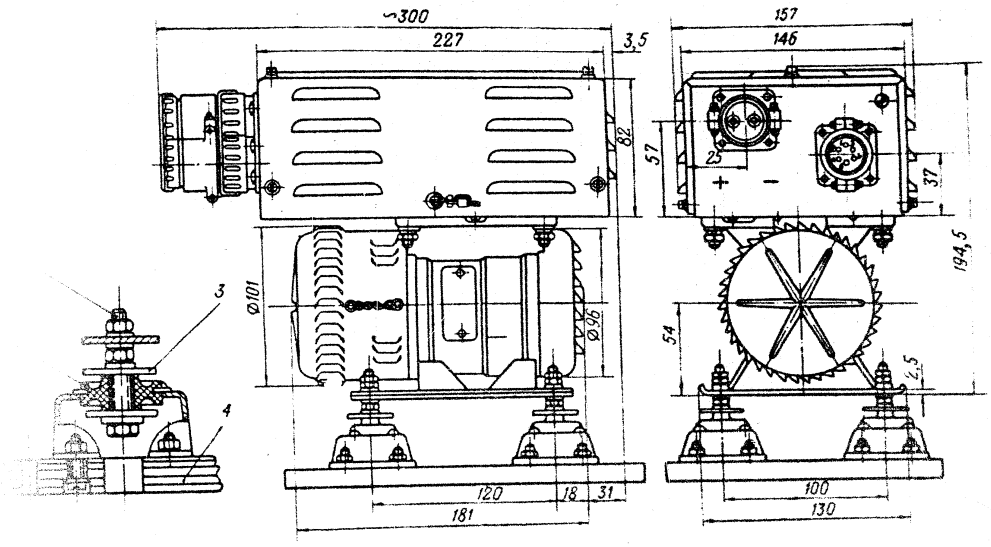


Fig.38. Outline-erection dimensions of the MA-100M units and recommended design of shock absorber and limiting washer .
1- Type 272C49-2-4 shock absorber ; 2- M6 bolt ; 3- Limiting 35 mm dia. washer ; 4 - Securing plate .

The point of installation of the inverter should preclude :

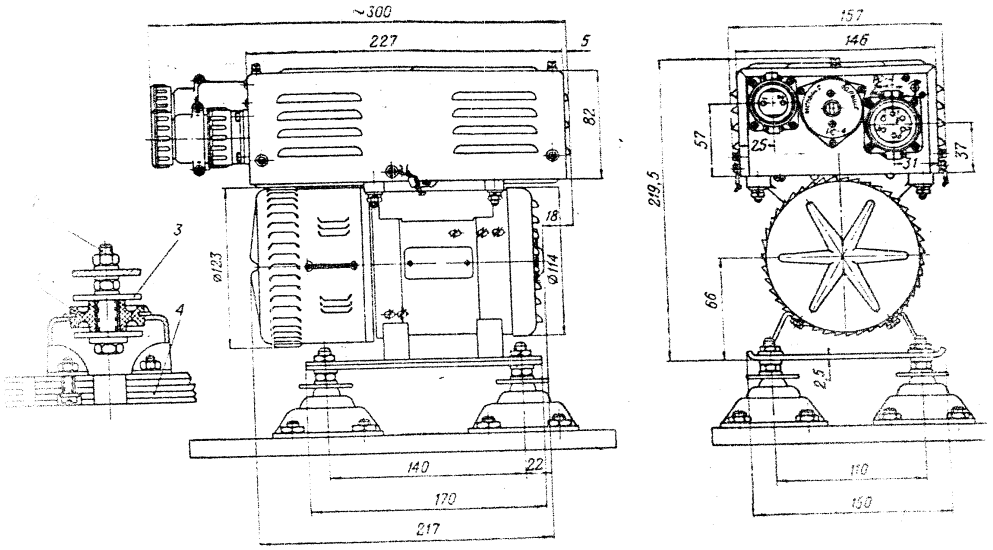
a/ heating of the inverter by other equipment , or direct contact with them ;

b/ possibility of contamination ;

c/ exposure to liquids ;

d/ possibility of accidental mechanical impacts;

e/ subjection to increased vibration .



...39. Outline-erection dimensions of the MA-250M units and recommended design of shock absorber and limiting washer.

...ype 272C49-2-6 shock absorber ; 2- M6 Bolt ; 3- Limiting ...m dia. washer ; 4 - Securing plate .

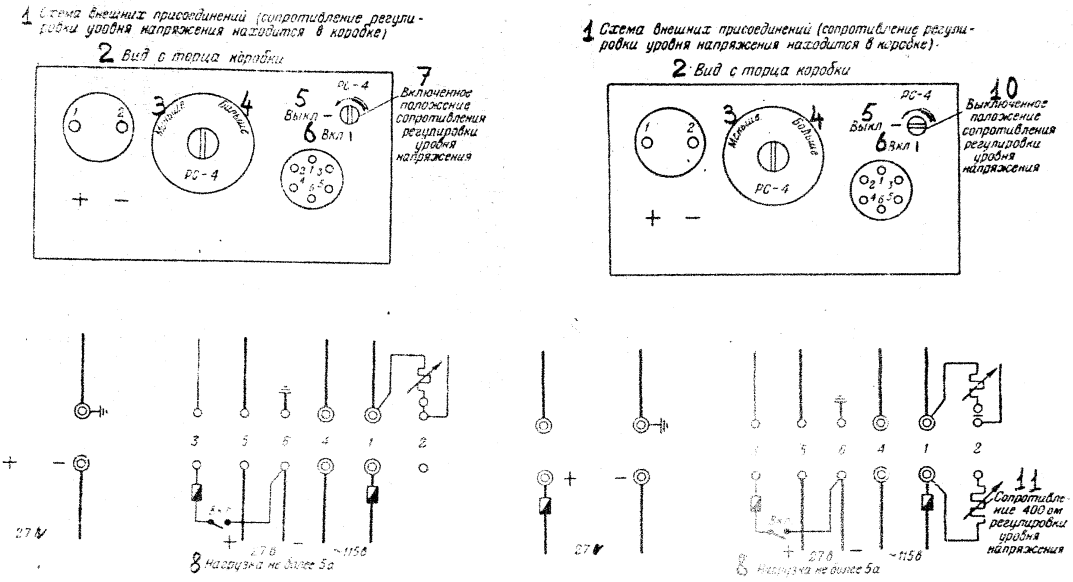
...t is desirable that the inverter be installed in a ...ce with a circulation of the air to increase the tranfer ...t from the unit with subsequent prolongation of its ...ice life.

Connection to the d.c. supply circuit is accomp - ...shed with a standard two-pin plug and receptacle coupler ...stoned on the end wall of the inverter control box , the ...nnection being made in accordance with the polarity markings.

Connection of the inverter to the supply circuit with the polarity reversed results in damage to the inverter .

The output is taken off through a screened cable with the aid of a standard plug and receptacle coupler.

The external circuit connections of the inverter unit are given in Figs . 40 and 41 .



. External circuit connections diagram of the MA-250M unit.

ternal circuit connections / voltage-level adjusting stor located inside control box /; 2 - View on control ; 3 - Lower; 4 - Higher ; 5- Out; 6 - In; 7 - Cut-in ion of voltage-level adjustiing resistor ; 8- Load not over ; 9- V ; 10 - Cut-out position of voltage-level adjusting ; 11- 400-ohm voltage-level adjusting resistor .

rotection against short circuits and overlo ds are incorporated within the inverter itself and must be anged in the external circuit by employement of fuses of proper rating in accordance with the external circuit diagram . In seledtion of the protection for the d.c. supply side , take in

consideration the starting currents of the units which , in the MA-100M units , are of the order of 160 amp., and in the MA-250M units , of the order of 250 amp.

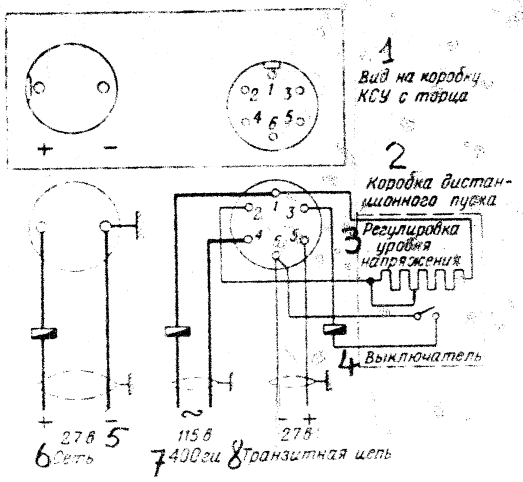


Fig.41. External circuit connection diagram of the MA- 100M unit .

1- View on end of KCY control box; 2 - Remote starting box; 3- Voltage-level adjuster ; 4 - Switch ; 5 - V; 6 - Supply circuit ; 7 - 115 V, 400 c/s ; 8- Transfer circuit .

Before installing the inverter unit , its a-c output voltage is to be checked under load.

Use a copper-oxide rectifier type of voltmeter with corrections for the coefficient of distortion of the output voltage wave form when checking , in order to attain undistorted readings.

The source of inverter power supply should be of sufficient power capacity to hold the voltage to within 20 volts when the inverter is started. If the supply circuit

cannot meet this requirement , a storage battery should be connected in parallel with it when the inverter is started. Connection of the inverter to a source of insufficient power will cause the starting contactors to fall into pumping operation with frequent opening and closing of the contactor /bell ringing/ and subsequent. outage.

II. Inverter Unit Operation

Pay attention to the loading of the inverters when they are in service , overloads are not to be tolerated.

To avoid outage of the starting and regulating devices, the supply voltage is not to be lower than 24.3 volts or higher than 29.7 volts when the unit is in service.

The a.c. voltage necessary for operation , between limits of 111.5 and 118.5 volts , is adjusted by a 400 -ohms rheostat in the external connection circuit , the necessary voltage being provided for under conditions of normal temperature by setting the rheostat slide to a 200± 10% ohm position.

These inverter units are not designed for no-load operation , since , under such conditions , the carbon pile is extremely loose and burning of the carbon discs may take place. In order to not allow the carbon-pile voltage regulator, and the starting devices to suffer damage , prolonged no-load operation of the inverter is not to be allowed.

Preventive Maintenance Shedule

To ensure reliable operation of the inverter units ,they are to undergo periodic inspections in accordance with the schedule recommended below in Table 15 .

TABLE 15

Schedule of Preventive Maintenance Work

Periods if Maintenance Work	Nature of the Work
1. After every 25 hours of operation	Inspect the commutator and brush assembly , check the fitting and free movement of brushes ; blow out deposits of brush dust .
2. After every 50 hours of operation	1. Carry out the 25-hour schedule work. 2. Measure and record the brush wear and clean the commutator, also clean out the between-commutator-bar gaps.
3. After every 200 hours of operation	Add grade CKB-122-7 grease to the ball bearings whenever needed .

Inspection of Commutator-Brush Assembly

a/ Condition of commutator working surface

The working surface of the commutator is to be clean and without traces of burning of the commutator bars, but care should be taken so as not to mistake the dark colour of the polish , which developes on the working surface and is not detrimental to commutator operation with burning of the bars. Do not remove the polish on the commutator surface . When contamination is present / deposits of greasy, motte, black nature /, the commutator is to be wiped off with a clean wiper rag slightly wetted with clean petrol / free from admixtures/. If this does not help , clean the commutator with a No.00 or No. 000 glass paper . Clean the commutator with the unit running by pressing a wooden stick , with the glass paper wrapped about it . against the surface. The use of an emery paper for this

purpose is prohibited . After cleaning of the commutator , blow out all deposits of dust left after this operation .

b/ Brush condition

The brushes are to be run in on the commutator and are to move freely in their holders. Cracked and broken-edge brushes are not to be used.

c/ Condition of brush-holder springs

The brush-holder springs , at their brush ends, should freely enter the brush slot without misalignment and seizure, and press down upon it at about the center of the slot.

Replacement and Running in of the Brushes

Whenever the brushes wear down , they should be replaced by brushes of the same grade. Brushes are to be considered worn out when their height is reduced to or below 12 mm.

The new brushes should freely enter the brush-holder and are to be throughly ground in to fit the face of the commutator with the aid of a No.00 glass paper and then run in.

III. Possible Inverter Faults , Their Causes and Methods of Remedy

Nature of the Fault	Cause	Method of Remedy
1. Increased sparking of brushes, which cause burning of commutator and increased brush wear	a/Poor fitting of brushes to commutator because of jamming in holder .	a/Remove brushes from brush-holder and slightly clean side surfaces with fine glass paper.
	b/ Poor fitting of brushes to commutator because of improper spring pressure .	b/ Set spring end in proper position. If it is discovered that pressure is too low, adjust the spring pressure .
	c/ Dirty commutator.	c/ Clean the commutator with a clean rag lightly moistened in petrol If the deposits remain, clean the commutator

Nature of the Fault	Cause	Method of Remedy
		with a No.00 glass paper wrapped upon a wooden or fibre stick .
	d/ A worn commutator	d/ Remove the armature from the inverter and turn the commutator in a lathe .
	e/ Commutator runs out of true .	e/ Replace the armature .
	f/ Shorted coil turns in armature winding	f/ Replace the armature.
3.Tin solder melts out of commutator bar risers .	Overheating of the inverter due to following causes:	
	a/ Worn out bearings or seizure of a bearing .	a/ Wash out bearings, replace the lubrication. Worn out bearings are to be replaced .
	b/ Short circuited armature winding.	b/ Replace the armature.
4.On swith-on of the inverter, the motor starts, with irregularity, and jerks.	a/Large drop in voltage in supply circuit when inverter is switched on.	a/ Change over to a more powerful source.
	b/ Bad contact in power circuit of starting box.	b/ Check the wiring and remedy the defects.
5.Low values of a.c.voltage: c/Voltage of 8-10 V	Broken field winding circuit in generator due to following causes: a/Bad contact in generator field winding circuit at terminal block in control box.	a/Tighten nuts on the terminals and make sure that leads of field winding are tightened by nuts .

	b/ Bad contacts between connectors in carbon pile circuit on terminal block of the regulator .	b/Tighten the screws in the terminal block of the carbon pile voltage regulator .
	c/ Broken lead at cable connectors in generator field circuit or at the KCY box terminal board .	c/ Remedy by soldering the broken lead.
b/Voltage of 60-100 V	Break down of capacitor / 1 or 0.25 mfd capacitance /in voltage-regulator coil circuit .	Replace the capacitor and adjust the d.c. voltage-level by aid of 500-ohm ITO-25 resistor.
6.Increased values of a.c. voltage:		
a/Voltage of 125-130 V	a/Broken voltage-regulator coil circuit.	a/ Check and restore the circuit .
	b/Shorted turns in voltage-regulator coil .	b/ Replace the voltage regulator .
b/Voltage of 125-135 V	a/Broken voltage-level adjusting rheostat circuit.	a/Restore the circuit.
	b/ Worn carbon pile .	b/Replace the regulator or its carbon pile.

APPENDIX

Directions for Conservation , Packing and Storage of the Inverter Units

For storage and transportation , the inverters are subjected conservation . The fitting parts /unpainted/ of the inverter and the nuts rd fastening/used to fasten screws the control box to the unit are given a coating of technical vaseline. Plug and receptacle couplers are wrapped in waterproof paper. The inverters , after treatment for conservation , are wrapped in two layers of waterproof paper and then packed in individual single-unit boxes of corrugated cardboard. The packed cardboard boxes are then , in turn , packed in wooden cases for shipment to the Purchaser . The cases must never be dropped or overturned during loading and unloading.

Cases received by the Purchaser are never to be allowed to be stored in the open.

The cases should be opened only in a closed warehouse. The inverter units should be stored without the packing , on wooden racks , in dry ventilated and heated premises, at a temperature between + 10 and + 30°C and a relative humidity between 45 and 70%.

The atmosphere in which the units are stored should be protected from fumes and gases which may cause corrosion .

It is prohibited to store the units and the spare parts in the same place with chemical reagents and substances which evaporate , such as acids , alkalies , charged storage batteries , etc.

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The atmosphere in which the units are stored should be protected from fumes and gases which may cause corrosion .

It is prohibited to store the units and the spare parts in the same place with chemical reagents and substances which evaporate , such as acids , alkalies , charged storage batteries , etc.

When the units are in storage , it is necessary to inspect them once every six months after they have been subjected to conservation by the Works. Whenever necessary , the conservation coatings are to be renewed on all external conservated surfaces . The date of conservation of the unit in the Works is recorded in the certificate of each inverter unit. Whenever galvanized steel parts show a white deposit , it is to be removed with a clean dry rag and the part coated with technical vaseline. Inverters delivered for storage over periods of two years are subjected to special conservation in the packed condition / together with their packing boxes/ by immersion in a bath of molten paraffine and ceresin.

The boxes in which the inverter units are to be packed for two-year conservation contain a small bag of moisture absorbing material / silica gel/. Units in such a packing should be stored for two years without inspection and opening of the packing. On elapse of this period , it is necessary to open the packing for inspection of the inverters. When removing the conservation coatings use a clean rag moistened with petrol. After this wipe the cleaned places dry with a clean rag.

CONTENTS

C.9

MOBILE REPAIRING AND CHARGING STATION

(HANDBOOK)

I. Description and short technical characteristics of the workshop

Description of the workshop.

The mobile repair and charging workshop, designated for overhauls, for charging and executing preventive repair cycles of the starting storage batteries under field conditions.

List of main operations to be performed by the workshop's crew. The crew of the mobile repair and charging workshop has to be perform the following operations:

1) To check mechanical conditions of storage batteries
2) To charge, discharge or recharge storage batteries
3) To prepare distilled water and electrolyte.
4) To dismantel batteries, wash the elements and exclude the faulty ones.
5) To replace faulty plates, lead parts, ebonit containers, cover, vent plugs.
6) To cast lead parts.
7) To reassemble the plate, groups elements and batteries.
8) To prepare wood separators.
9) To fill up cracks in the sealing, to fix covers with sealing composition and paint receptacles.

The main data of the mobile workshop.

The chassis of the mobile shop .....three axle truck ZIS 151

Kerb weight of the mobile shop about kg..... 8.500

Overall dimansions of the shop

(in mobile state) mm length..... 7.130

wigth..... 2.460

height..... 3.100

Engine type...six cylinder four stroke with carburettor

Maximum output at 2700 r.p.m. HP..... 95

Lubrication system..... combined

Lubrication system capacity.....8

Oil typ in summer.....Engine oil SU GOST 1707/42 or Avtol 10 GOST 1862-42

Cooling system.....water with forced circulation

Capacity of the cooling system l..... 21

Fuel..... automobile petrol A/66 GOST 2084-48

Fuel capacity, l..... 300

Ignition system..... battery 12 V

Performance data:

Maximum speed on tarred road (highway) km per hour..... 60

Average speed on field roads km/h..... 25

Average speed on tarred roads km/h.....40

Drive range without refuelling, km

on tarred highways -.....600

on field roads.....470

Body of the mobile shop.....standard wooden-metallic PM-O-KU

Generator set of the mobile shop:

output kw..... 10,5

engine..... GAZ-67 B

generator..... PN-100

fuel consuption per hour, l..... 8,5

Charging unit..... portable type for eight charging-discharging groups, in two boxes

Time required for repairing the mobile shop for operation, min..... 40

Time required for dismetling, min..... 20

II. General description of the mobile worshop.

Description of the body.

The mobile repair and charging shop consists of a standard wood-metal body (fig.1,2,), in which the equipment, accessories tools, material, personall belongings, arms of the crew and the crew itself are housed.

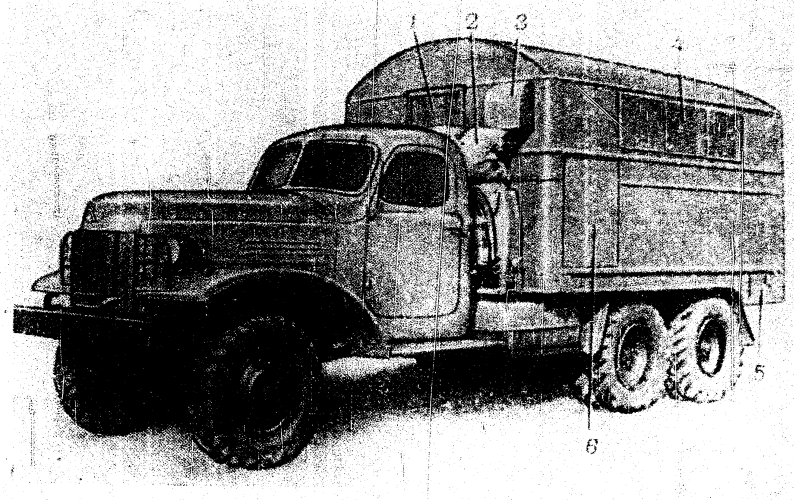


Fig. 1.- General view of the mobile shop.

1 - window in the front wall, 2 - tent in mobile condition, 3 - ventilator housing, 4 - side-window of the body, 5 - L.H. bottom box, 6 - niche door. The framework of the body is veneer-panelled inside and sheet iron outside. For heat-insulation varnish soaked paper is inserted between the outer and inner panels, the inner side of the paper being painted with aluminium heat reflecting point.

The body has a wooden floor. Below the floor are placed two boxes for the accessories of the workshop.

In the rear wall of the body is a two wing door. On the narrow door wing is placed the niche, in which the trench-tools are placed. In the side-wall of the body are three windows, in the front wall one window and one window is in the bread door wing. The front window on the left and the back window on the right wall are openable. All windows are protected by removable metallic netting from outside and with cloth-blinds from inside. All blinds can closed and fastened by hooks and clamps in case of blackout.

Outside, on the rear wall of the body is placed a ladder hinged on the door wing in special guides. In mobile conditions the ladder is fixed to the narrow wing of the door. To the right of the door is fixed the box for keeping coal and wood.

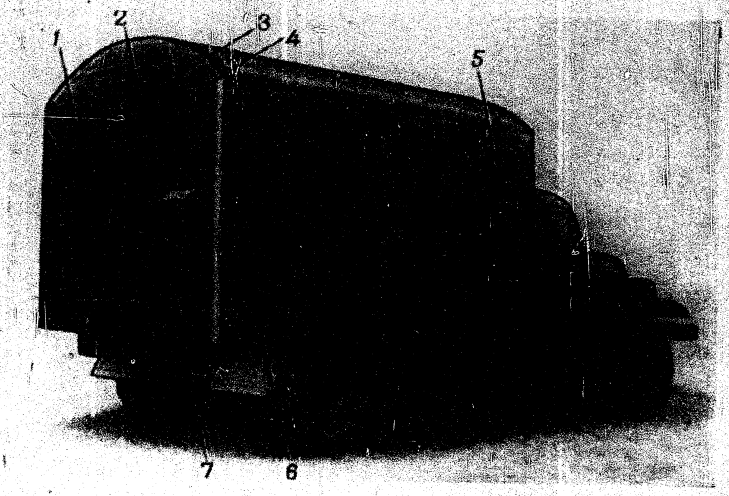


Fig.2: - Three quarter rear view of the workshop.
1 - Ladder, 2 - rear wall window, 3 - hinge, 4 - opening for stack of the stove, 5 - exhaust tube of the generating set, 6 - right-hand box under the body, 7 - fuel box. The boxes are placed under the body floor at the right and the left side. In the left hand box is placed the socket box consisting of two sockets 120 V for the charging unit and one socket 12 V for portable lantern. On the right hand side under the body are placed the accessories of the workshop.

In the right corner of the body, at the entrance door, is established an iron stove for heating and for cooking. The walls, the ceiling of the body and the right hand bench are separated from the stove by special screens. In the front of the body is placed an electric fan. In the front part of the side walls of the body are openings for access to the engine, generator, batteries and for the ventilation of the niche. In the floor near the front body wall a rectangular opening for cooling air intake is provided. On the left side wall outside the body, the hooks and the iron shackles of the folding tent are fixed. When in driving state the tent is fixed with leather straps to the brackets on the body front wall.

Arrangement of the equipment in the body.

The pictures 3, 4, 5 and 6 is shown total view of the workshop and the layout of the equipment. On the left wall is placed a cupboard for the personall belongings of the crew and a double bench.

on which are mounted the plate oresses. On the exterior side wall of the cupboard are placed special holders for fixing of the tent posts, when driving.

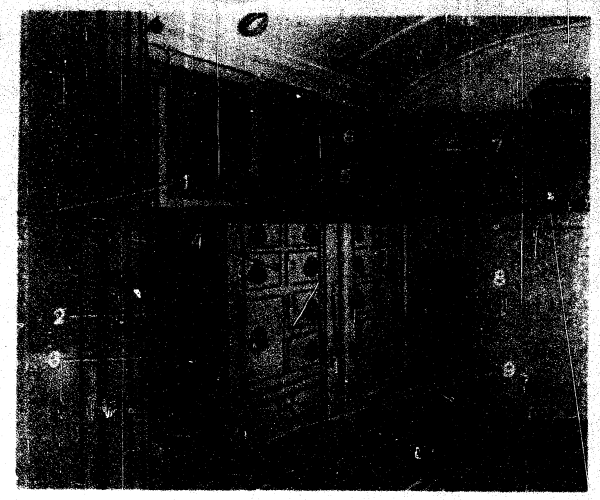


Fig. 3: Inner left side view of the mobile workshop.

1 - cupboard, for personall belongings, 2 - tent posts, 3 - folding chair, 4 - left hand bench, 5 - plate press, 6 - blackout blinds, 7 - electric fan, 8 - tent window cover, 9 - charging unit.

In the lower part of the left bench are placed two boxes containing the charging unit parts. In the upper part are placed the boxes with tools, fixtures, accessories and material. On the front wall of the bench brackets for the personall arms of the crew are fixed.

Along the right side is placed a bench; on its upper desk is fixed an electrical distillator and a vice.

In the lower part of the right hand bench are placed three tanks for electrolyte and vessel for preparation of wood separator, on the top-part are placed boxes with accessories and workshop tools.

Between the bench and the partition of the niche is fixed a wood-box, in which is placed a bottle with sulphuric acid for the batteries.

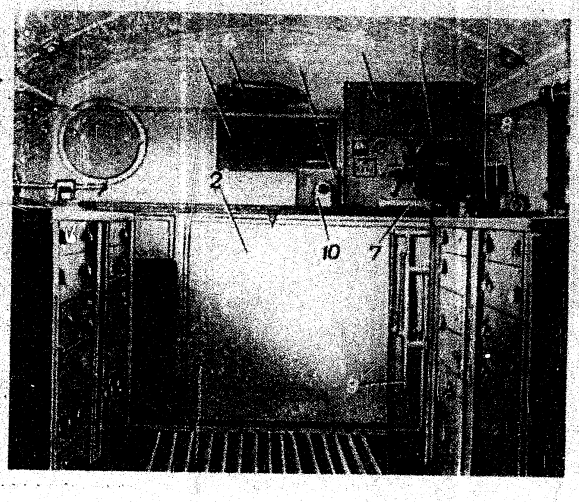


Fig. 4: - Inner-view of the workshop front wall.
1 - vice, 2 - niche for the generator set, 3 - window in the front wall, 4 - fire-extinguisher, 5 - generator controller, 6 - central switch- board, 7 - cutter for wooden separators, 8 - solder socket, 9 - folding table, 10 - grounding switch.

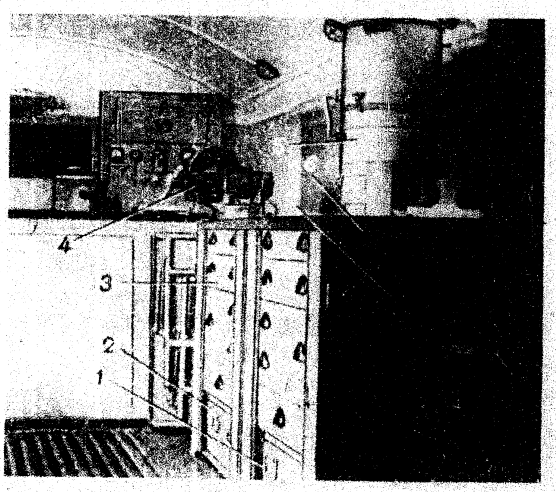


Fig.5 : Inner R.H. view of the workshop.
1 - vessel for preparation of separators, 2 - tanks for electrolyte, 3 - right hand bench, 4 - vice, 5 - electrical destillator, 6 - protective screen, 7 - heating stove.

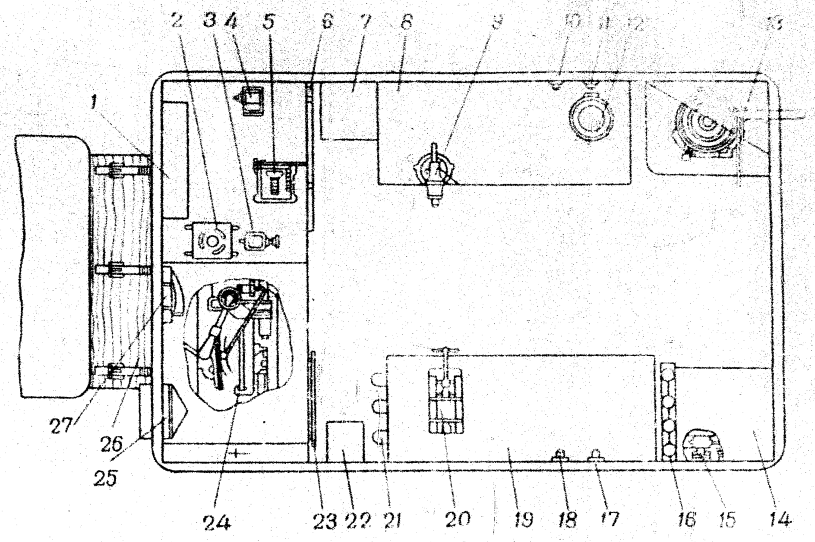


Fig. 6: Lay-out of the equipment.
1 - central switch-board, 2 - controller, 3 - grounding switch, 4 - socket for solder, 5 - cutter for the wood separators, 6 - folding table, 7 - bottle box, 8 - right hand bench, 9 - vice, 10 - 12V socket, 11 - 120 V socket, 12 - electrical destillator, 13 - stove, 14 - cupboard for personall belongings, 15 - plug socket box in the underbody box, 16 - tent posts, 17 - 120 V socket, 18 - 12V socket, 19 - left hand bench, 20 - plate press, 21 - arms bracket, 22 - distributor of electrolyte, 23 - tent window cover, 24 - generator set, 25 - electric fan, 26 - tent during the mobile state, 27 - fire extinguisher.

In the niche on a special frame is fixed the generator set and a storage battery of the type 6STEN-140M. In the middle part of the niche is placed a cover, which is fixed with latched to the front wall of the body and is locked with two bars. The cover is kept in open position by a special holder. An inspection and servicing of the generator set and batteries is possible only when the cover is open.

On the niche desk is fixed a special 12 V socket plug. for connection of wires from a carbon electrode holder, governor of the generator PN-100, grounding switch and cutter for separators.

To the right on the front wall of the body is the central switchboard of the workshop, on which are arranged control instruments and regulators of the generator set.

Electrical equipment od the mobile workshop.

The electrical installation of the workshop consists of two current systems: hight tension (120 V) and low tension (12V). The general wiring diagram of the workshop is shown on fig.7.

The generator PN 100 produces current for charging batteries, feeding the electrical destillator, electric stove, soldering iron and portable lamps for 120 V D!C.

The generator G 20, which works simultaneously, serves as source of the low tension net work and is driven by the engine of the generator set, another source of the low-tension networks is the battery.

The electrical energy of the generator when the generator set is working, is used for charging the batteries, for internal lights of the body and niche, for feeding of the fan motor and portable lamps.

The electrical energy of the battery is used for feeding of all electrical accessories of the 12V circuit, in case the set is not working, and of the engine starter and ignition system of the engine (at low r.p.m.).

At simultaneous work of the generator and batteries the electrical energy is used for electric soldering of the lead parts. To the electrical accessories the electric current is supplied from the source via the central s itch board 6 (fig.4).

The fuses of the type PR-1 which are placed on the central switch-board and on the switch-board of the charging unit protect the high tension circuit.

The low tension circuit is protected by fuses (type BZ-30) situated on the central switchboard and on the lighting panel. The 100 A socket is protected by fuses of calibrated wire, which are also installed on the main switch-board.

All fuses are mounted in special fuse boxes, covered with lids. On the lids are inscriptions showing to which circuit the fuse belongs and what kind of the fuse it should contain.

On the central switchboard and on the charging unit the ampermeters and voltmeters of the type PM/70 are placed.

For s itching on and over the high tension circuit, switches of the type PK are provided, for the low tension circuit of the type 69 K, V-45 and PP-45.

The generator PN-100 is switched in by the main switch, which is placed in the centre of the switch-board. To switch on the battery the grounding switch "10", placed on the board of the niche is used.

On the right wall of the body above the windows, are fixed two sockets 10 and 11 (fig.6): the first one for 12V for the switching on the portable lamp, the other one for 120 V for the switching on the electrical distillator.

On the left wall of the body above the window is fixed a socket 17 for 120 V for switching on the electrical stove and electrical solder.

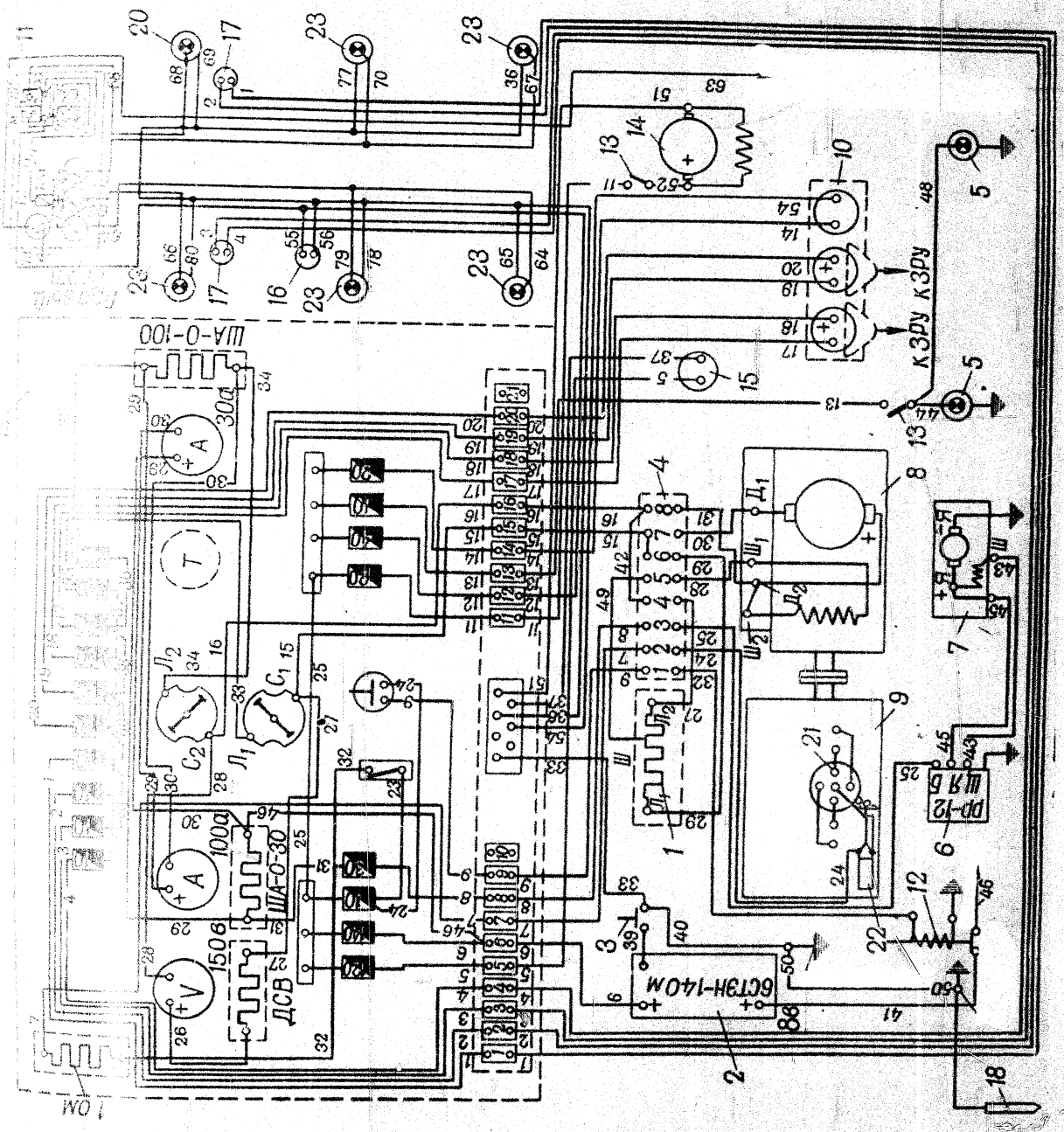
Fig. 7: - General wiring diagram.

1 -shunt field rheostat RV-6,5
2 -storage battery 6-STEN-140M
3 -grounding switch VB-404
4 -terminal board
5 -niche lighting PT-37
6 -relay governor RR-12
7 -generator G.20
8 -generator PN-100
9 -engine
10 -outer socket box
11 -lighting board
12 -starter relay
13 - switch 69/K
14 - fan motor MV-42
15 - solder socket
16 - socket IT, 12 V
17 - socket 120 V, 6 2
18 - grounding pole
19 - central switch board
20 - blue light lamp
21 - distributor
22 - ignition coil
23 - inner light

Six lamps, which are placed on the ceiling over the benches light the body. In each lamp is one bulb (13V, 15V or 02 V, 21 c-p.). The left hand lamp with a blue bulb serves in case of blackout.

The bulbs are fed through the light-panel, which is placed on the rear wall of the body over the door. On the front wall of this panel are placed three switches and 1, 3 or all 5 lamps can be switched on by them.

On this panel is placed an automatic switch, which switches off all the white lights in case the door is opened and switches over to the blue blackoutlight. In case it is necessary that the white lights are "on" even when the door is opened, the automatic



switch can be put out of action by turning a lever of a switch, which is on the right side of the pancl. For the work in the night lever of the special switch must be always in such a position that by opening the door the main lights are switched off and the black out light is switched on.

The niche of the generator set is illuminated by two lamps, which arw placed on the front wall of the body and have a common switch, which is placed at the side of the left lamp.

On the lighting panel is placed the push-button of the sound-signal for the connection with the drive.

For grounding of the generator set is a special grounding device in form of a pole with a wire.

III. Main equipment of the workshop.

Generator set.

The generator set is provided for producing electric energy, for charging the batteries, lighting of the workshop body-room and for feeding of the special electric equipments.

The generator set (fig.8 and 9) consists of the engine and D.C. generator PN-100, which are mounted on a common frame and are connected to each other by an elastic coupling.

The outside dimensions of the generator set are:
lenght 1,734 mm, width 640 mm, height 920 mm.
Dry weight of the set.....740 kg

The motor is fixed to two supports. The engine brackets are fixed to the front support by two bolts. The rear support has a form of a cast-iron housing, which is fixed by means of two bolts to the engine fly-wheel and by means of two bolts to the common frame.

The radiator of the cooling system is placed in the front part of the common frame on a cast iron bracket. Two side posts (made of angle iron) and two clamp rods adjust the position of the radiator. Between the lower tank of the radiator and the bracket is placed a rubber insert for damping the vibrations.

The generator PN-100 is screwed to the common frame ba means of four bolts and beside this the two botton brackets of the generator are fixed by means of pins which are driven in after assembly and aligning of the generator and engine.

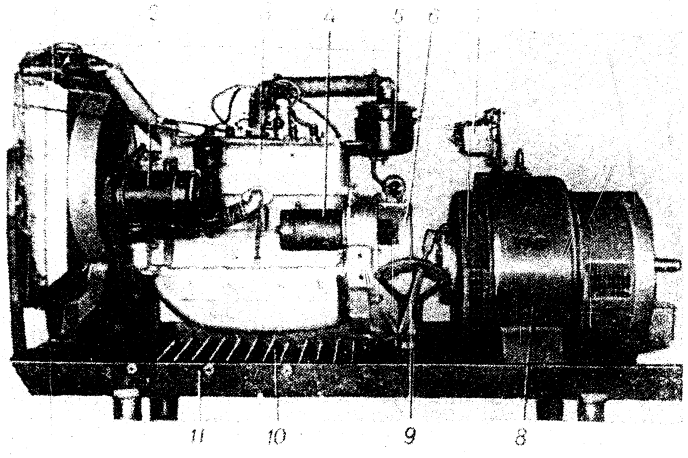


Fig. 8: Generator set (left side- view).
1 - radiator, 2 - generator G-20, 3 - engine, 4 - starter, 5 - air-filter, 6 - rear support of the engine, 7 - relay-governor RR-12, 8 - generator PN-100, 9 - controll handle of the shutter, 10 - shutter, 11 - frame

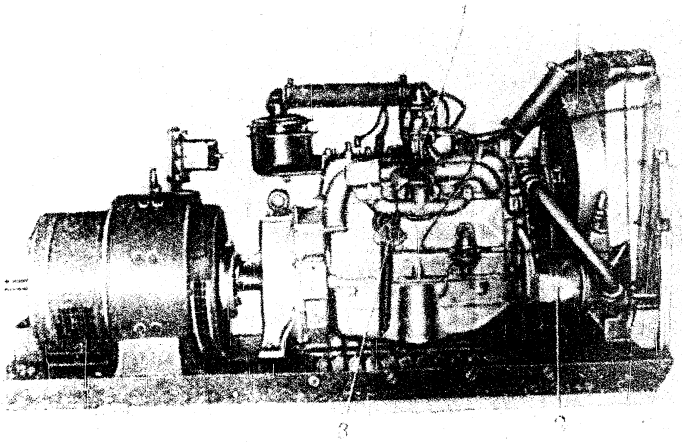


Fig. 9: - Generator set (Right side view)
1 - carburettor, 2 - centrifugal speed governor, 3 - throttle control lever.

On the generator PN 100 is fixed the relay-governor RR -12, which operates with the governor G-20. For starter switching is used the relay RPB-1(with a changed windings) which are calculated for the tension of 12V). The relay of the type RPB-1 is fixed on the left side of the set on the cover of the engine fly-wheel casing. On same side of the set near the rear bracket is fixed the guided shutter control lever. The shutter is placed on the frame under the engine starter.

From the centrifugal governor lead two pipes, one of them is connected with a fitting of the engine crank-case provided, for the return oil, from the centrifugal governor; the other one with a screwed plug on the end aleads below the radiator and serves for draiving the surplus oil.

In the lower part of the engine is placed the fitting with the pipe leading under the radiator for draining the oil from the engine crank-case.

The petrol pump of the engine is connected by means of a pipe with the left hand petrol tank of the truck.

On the floor along the niche are fixed rails, on which the generator set is sliding into position.

When positioning the generator set into the niche one takes off first of all the radiator and the air cleaner with the joining pipe. The frame of the generator set is fixed to the floor by [illegible] bolts. To avoid misalignment of the generator set the bolts are to be tightened uniformly.

For proper fixing of the set under the floor of the body iron strips with bolts holes are arranged. After the assembly and fixing of the generator outfit, the radiator and the air cleaner is reinstalled, fuel pipe leading from the fuel pump connected with petrole tank and the exhaust pipe protruding out of the inside wall of the workshop, parallel with the exhaust pipe the door is fixed.

For safety the exhaust pipe from the exhaust collector tube is insulated by asbestos. Even the slot in the floor, through which the exhaust pipe leads, is insulated by asbestos.

To prevent the exhaust gases from returning back into the workshop, the exhaust pipe is prolonged vertically and ends over the roof of the body. The vertical pipe is fixed by a clamp and a split pin, which is inserted in the lug of the bracket and pipe. In the mobile state the vertical pipe is taken off and is put into the niche.

Engine.

The engine is of the fourstroke carburetter type specially adopted for stationary operation.

Specification of the engine.

maximum output at 1500 r.p.m. HP	23 - 30
cylinder number	4
cylinders bore, mm	98,43
Piston stoke, mm	107,95
Compression ratio	4,6
Firing order	1 - 2 - 4 -3
Cooling system-	water cooling with forced circulation
radiator	tabular, sixrow with opening for starting handle
fan	with six blades
Capacity of the cooling system	1 - 16
Lubrication system	mixed
Capacity of the lubrication system, l	4,7
Oil to be used	Avtol 10
Carburetter of the type	K-22B, K-22A or K-23B
Petrol pump	diaphragm type, with a lever hand pumping
Fuel to be used	GOST 2084-48 the automobile petrol A-66
Capacity of the tank, l	150/the left hand tank
Speed governor	centrifugal of the type KB-31010
Air filter	oil bath type

The engine (fig.10 - 13) consists of the cylinder head cylinder block lower half of the crankcase, crank mechanism, fly-wheel, valve mechanism, lubrication system, cooling system, fuel system and of electrical equipment.

The cylinder head is of cast-iron. It is fixed to the cylinder block by 14 bolts. Between the head and the block is a steel asbestos gasket.

The cylinder block of the engine is also of cast-iron. On the left side of the block valve seats and guides are arranged. At the front of the block is fixed the timing gear cover. At the rear the fly-wheel casing is fixed. Inside the block the upper halves of the main bearings and support of the beds for camshaft bearings are located.

The lower half of the crankcase is pressed of steel and serves as oil pump, it has double bottom and througs for the oil. To this bottom are welded three partitions, which stabilize the oil movement when engine running.

Between the lower half of the crankcase and the cylinder block is placed a cork gasket.

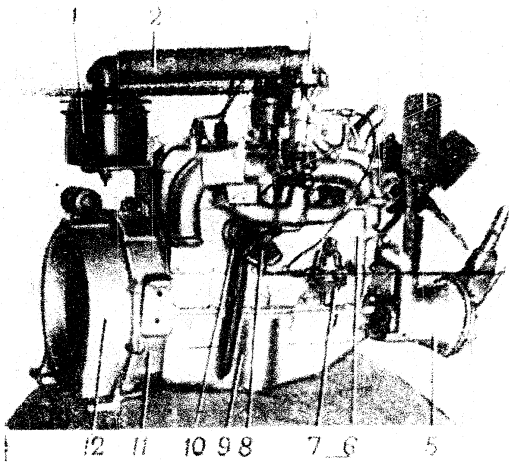


Fig. 10: - Engine (the view from the carburetter's side).
1 - air filter, 2 - air filter connection pipe, 3 - carburetter, 4 - fan, 5 - centrifugal speed governor, 6 - cylinder block, 7 - petrol pump, 8 - throttle valve control, 9 - crankcase, 10 -breather and filter, 11 - fly-wheel case, 12 - rear support of the engine.

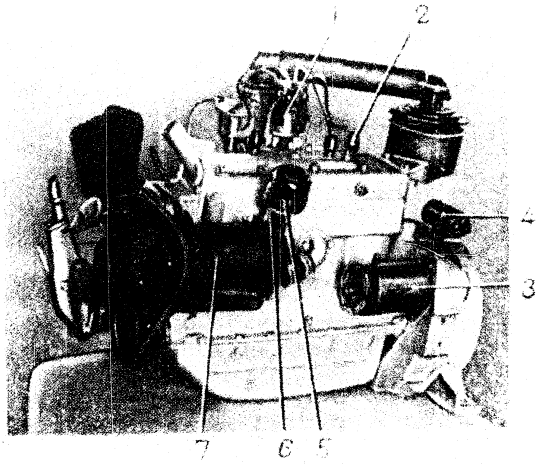


Fig.11: - Engine (view from the generator side).
1 - ignition distributor, 2 - spark-plug, 3 - starter motor, 4 -ignition coil, 5 - cover of the oil filter tube with a filter, 6 -oil filler, 7 - generator.

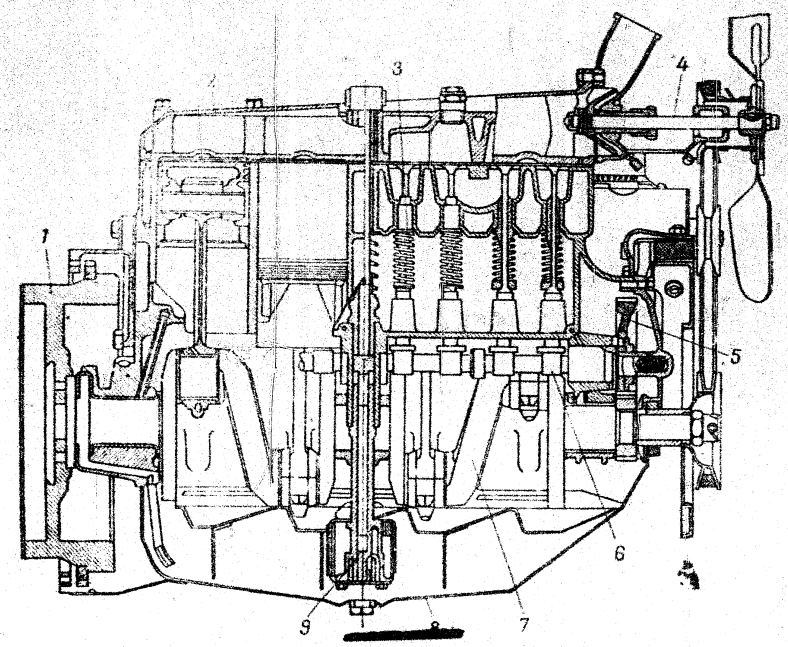


Fig. 12: - Engine (longitudinal section)
1 - fly wheel, 2 - cylinder head, 3 - valve, valve spring, valve tappet, 4 - fan shaft, 5 - textolite camshaft gear, 6 - camshaft, 7 - crancksha ft, 8 - crankcase, 9 - oil pump.

The crank mechanism consists of the crankshaft, connecting rods and pistons.

The crankshaft is of steel. On the crankshaft are three main journals and four crankpins and counterweights preventing main journals to be destroyed by centrifugal forces.

The main bearings are lined with a low lead content babbite alloy, mark BMN. Between the bearings is inserted a set of shims, which are gradualy removed according to wear of the bearings.

The pistons are made of aluminium alloy, on their cylindrical parts grooves for two compression and one scraper piston rings are placed.

The gudgeon pins are of the floating type and are locked by circlip each.

The connecting rods are of steel, forged of H section. In the upper eye of the connecting rod is pressed a bronze bush, the lower eye is lined with low content babbit.

The fly-wheel is made of cast iron and is fixed to the flange of the crankshaft by four bolts, secured by split-pins. On the fly-wheel is pressed a ring gear.

The valve gear mechanism consists of a camshaft valves, valve springs and tappets.

The camshaft is of steel forget, it has eight cams and three journals. In the middle of the central journal is fitted the drive gear of the oil feed pump and of the ignition distributor. The camshaft is driven by the crankshaft through the medium of the gear set.

In the timimg gear cover is placed a spring loaded plunger, w which prevents the camshaft from axial movement.

The exhaust valves are made of heat resisting steel. On the heads of inlet valves are provided annular grooves and punched the letters "BP" and on the other side of the head is the number M 6504.

The valves guides are made of cast iron and consists of two halves each, which are assembled into the bosses of the cylinder block at the right side of the engine.

The valve tappets are made of cast-iron too; to obtain the necessary clearance between valve stem and tapped head, a setting screw is fixed in the valve stem.

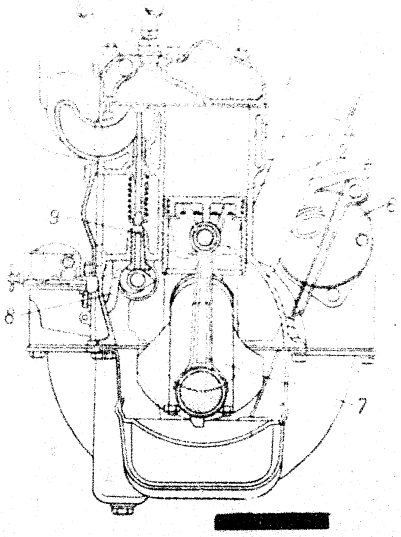


Fig.13: -Engine (cross section).
1 - cylinder head, 2 - piston, 3 - oil filter cap with the oil filter, 4 - cylinder block, 5 - oil filler tube, 6 - generator, 7-connecting rod,, 8 - lever of the petrol pump, 9 - distribution gear mechanism.

The clearance of the inlet valves are 0,25- 0,30 mm and of the exhaust valves 0,40-0,45 mm. The valve are slid on valve stems and are held in position by two split collars each. The lubrication system of the engine (Fig.14) is combined.

The main bearings of the crankshaft and the bearings of the camshaft are pressure-lubricated, all other parts by oil splash.

The oil is added into the crankcase through the filler 5 (Fig. 13), which is covered with a lid equipped with a strainer. For draining the used oil there is a pipe, one end of which is fixed to the crankcase draining hole and the other one leads under the radiator to the front of the generator set. The pipe ends with a fibre sealed cover.

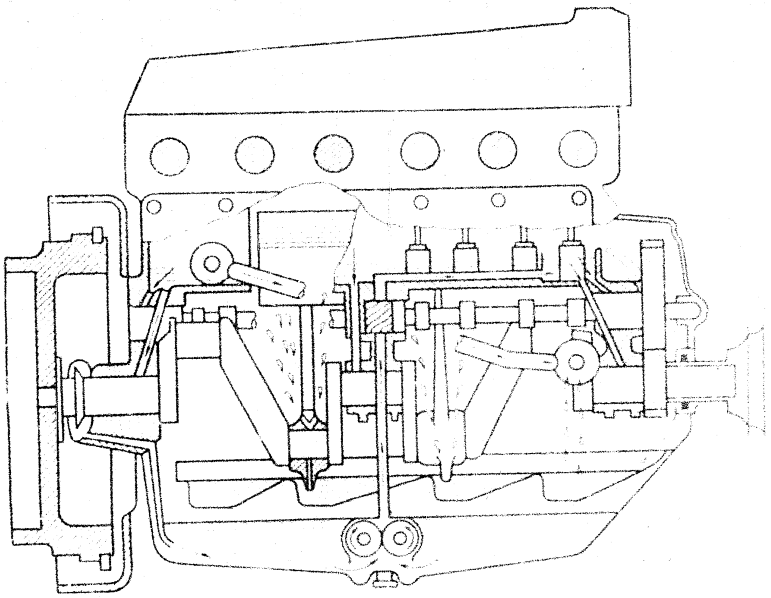


Fig. 14: - Lubrication of the engine.

The oil is forced from the crankcase by means of the oil pump, which is driven by the crankshaft through a gear and a short vertical shaft.

The oil passes to the pump from the crankcase through a sieve and flows under pressure through a vertical channel into a horizontal one. From the horizontal channel the oil flows through bores and pipes to the crankshaft main bearings to the journals of the camshaft, to the gears and from there it flows down to the oil trough crankcase. From this trough it is pumped by the connecting rods through their borings into the crank bearings and is sprayed into the crankcase. By the crankshaft motion an oil mist is produced, which lubricates the cylinder piston-walls, valves and gudgeon pins. The surplus oil from the valve chamber flows into the trough of the crankcase through a pipe.

On the right side of the engine to valve chamber cover is connected the breather pipe 10 (Fig.10); the lower end of the pipe is chamfered, this chamfer aiming at the fan. The upper end leads into a cylindrical casing, in which the small cleaner strainer is located. When the engine is running the fan provokes a suction effect in the lower end of this pipe and fresh air is sucked in - to the crankcase through the opening in the lid of the oil filler tube. It passes through the crankcase and ventil tes the crankcase from petrol vapours and exhaust gases.

The cooling system (Fig.15) consists of the cylinder block water-jacket, pump, radiator, fan, water pipes and durit hoses.

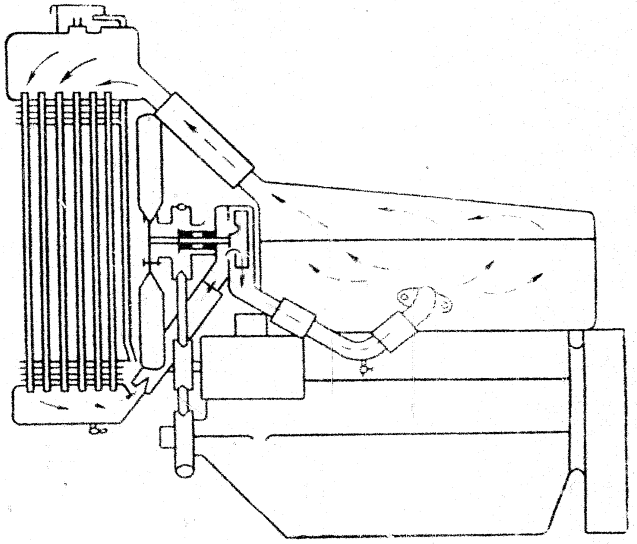


Fig-15:- Engine cooling system scheme.

The water cooling system of the engine is of the closed type, with forced circulation. The water-pump, placed at the front of the cylinder block, circulates the water in a closed circuit: pump- cylinder jacket- cylinder head jacket- upper radiator header- cooling tubes of the radiator- lower radiator header pump.

For closing the cooling system the radiator cap is sealed by two gaskets one of which is of rubber placed in the body of the cap and the other one of fibre in the radiator filler neck. Only by accurate fitting of both gaskets the cooling system works normally.

The water pump of the centrifugal type is fixed on the same shaft as the fan and the driving pulley. The pump is enclosed in a cast iron body bolted to the cylinder block. Between the cylin-

r block and the pump-body is mounted a cast-iron fitting knee, ich is connected by pipes and durit hose with the upper and lo- r radiator headers as well as with cylinder block water packet ipe.

Bearings of the pump-body are lubricated by means of grease nip- les throug, which constalin is forced by grease gun.

The water of the cooling system is drained through two cocks, one of which is placed in the lower part of the radiator and the other one on the pipe of the water jacket.

The fan secures an intensive cooling of the cooling water and of the oil in crankcase. The fresh cooling air enters through on opening under the crankcase, passes round the engine, the water cooler and escapes through the left door in the niche of the body.

To improve water-cooling in the radiator, the radiator is equip- ed with a shroud, directing the air flow.

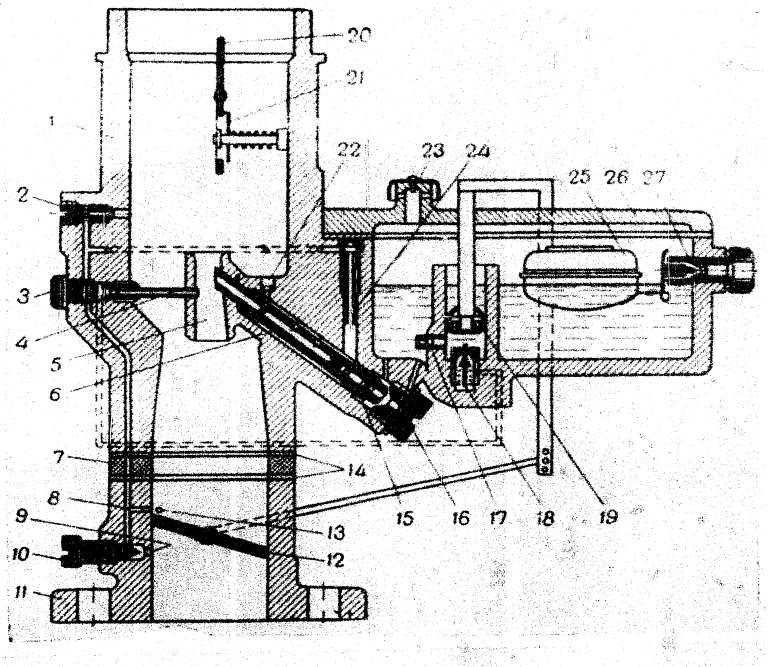


Fig.16:- Carburetter K 23 B (general scheme).
1 - body, 2 - air set for idling, 3 - plug, 4 - accelerating pump emulsion tube, 5 - inner venturi, 6 - main metering system emulsion tube, 7 - heat insulation, 8 - 9 - feeding ports for idling, 10 - idle setting screw, 11 - throttle valve tube, 12 - throttle valve, 13 - regulator boring, 14 - paper gasket, 15 - main set, 16 - main set plug, 17 - feeding valve, 18 - economizer valve, 19 - accele-

fitting pump plunger, 20 - choke valve, 21 - relief valve, 22 - main metering system air set, 23 - float chamber checking hole cap, 24 - idle set, 25 - float, 26 - float chamber cover, 27 - needle valve.

The water pump and the fan are driven from crankshaft pulley by means of a "V" belt. Tension of the "V" belt can be regulated by setting off the generator.

The fuel system consists of a fuel tank, carburetter, petrol pipes, petrol pump with sediment bowd, inlet tube air filter.

The carburetter (Fig.16) mounted on the engine left hand side and is fixed by two bolts to the inlet tube.

The petrol pump (Fig.17) of the diaphragm type is placed on the left side of the engine at the bottom of the cylinder block. It is driven vy a cam on the camshaft.

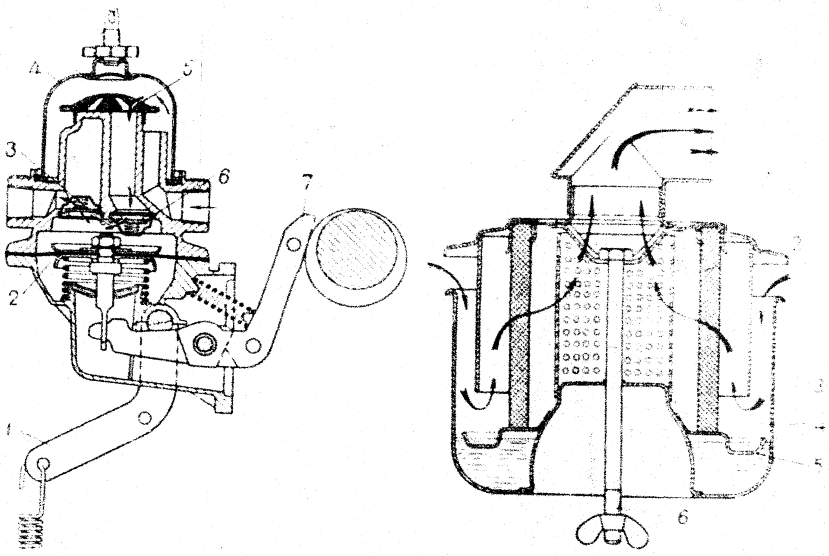


Fig.17: - Petrol pump.
1 - hand pump lever, 2- diaphragm, 3 - pressure valve, 4 - sediment bowl, 5 - strainer, 6 - intake valve, 7 - cam lever.
Fig..18: - Air filter.
1 - fitting, 2 - central tube, 3 - oil container, 4 - strainer, 5 - oil baffle, 6 - bolt.

For checking the pump operation and for primary filling of the float chamber, a hand pump lever on the petrol pump is disposed. The petrol is equipped with a sediment bowl strainer, and upper lid, fixed by a nut.

The air strainer filter (Fig.18) is destined for cleaning of the intake air from dust. The filter is fixed on a special bracket and is joined by means of a special pipe with the flange of the air inlet tube.

Electrical equipment of the engine.

The electrical equipment includes: source of the electric current, ignition system leads, starter motor with an electromagnetic switch and aero thermometer contact.

To the source of the electric current belongs the generator G 20 12 V, 18 A , which cooperates with the relay governor and the storage battery of the type T 6 STEN-14I M.

The relay governor serves for automatic switching on and off the circuits, generator storage battery, for governing the voltage and a protecting the generator from overloading, It consists of three separate devices: reverse current, relais, of voltage regulator and current- regulator. The ignition system is of the battery type. The nominal voltage of the system is 6 V. In the ignition system is inserted an additional resistance mounted on the central switchboard. To the device of the ignition system belongs an ignition distributor, ignition coil, the sparking plugs and ignition switch.

The ignition distributor, type R -15 or R-30 is provided with a centrifugal governor (ignition advance). The setting of the ignition timing is automatic. With revolutions of the engine rising the angle of the ignition advance grows.

The setting of the ignition is corrected by means of a hand advance. Each grade of the hand advance corresponds to the advance angle of 2° according to crankshaft rotation angle. By turning the distributor body clockwise the advance angle creases and by turning anti-clockwise decreases.

The gaps between opened cantacts of the interrupter may be in the limits of 0,45-0,55 mm- The ignition coil of the type KZ 14 or IG-4085 is destined to transform the low tension current into high tension current, necessary for producing sparks in the sparking plug. The sparking plugs used for the engine are of the type M 15/15 or M 12/15. The gaps between electrodes of the sparking plugs may be in the limits of 0,6-0,7 mm.

On the engine is equipped with a starter motor of the MAF-4006 type. When starting the engine the starter is switched on by the electromagnetic switch RPB-11, the winding of which is calculated for 12 V insteat of 24 V. From the battery to the starter flows 8 V current.

The ignition switch, starter button and of air thermometer dial are placed on the central switch-board.

The speed governor is placed in the right front part of the motor in a special cast iron housing 1, fixed to the cover of the governor driving gear.

From the front the governor is covered by a special shaped lid 8 in the neck of which is placed the regulating spring. On this neck is mounted a mechanism for altering the spring tension. The body of this mechanism ends with a specid head 4, by turning of which the spring tension can be altered, thus the revolutions of the engine are kept steady in the necessary limits.

The mechanism of the governor works in the following way: Weights 16, jointed on pins 17, when rotating move apart due to centrifugal force. There by overcoming tension of the contracting springs 3 push by their ends the sliding ring 2 to the left. The end face of the sliding ring is hardened and ground, which transmits the motion of the sliding sleeve to the roller 12, to the lever mechanism of the throttle valve drive.

In case the load of the generator being lowered the revolutions of the engine tend to rise rapidly. The r.p.m. regulator acts on the lever 10 of the throttle valve through the sliding sleeve thus moving the lever to the left, closes the throttls valve and secures the r.p.m. decrease in correspondance with predetermined limits. When load increases acompanied by a corresponding decrease of r.p.m. the lever 10 forced by the spring 9 moves the right whereby opening the throttle valve.

One end of the regulation spring 9 is fixed to the lever and roller, the other one to the screw for adjusting the spring tension. Increasing the tension of the spring e.i. turned clockwise head, the pressure of the roller on the sliding sleeve rises whereby the revolutions of the engine rise. Turning the head counter clockwise the number of revolutions decreases.

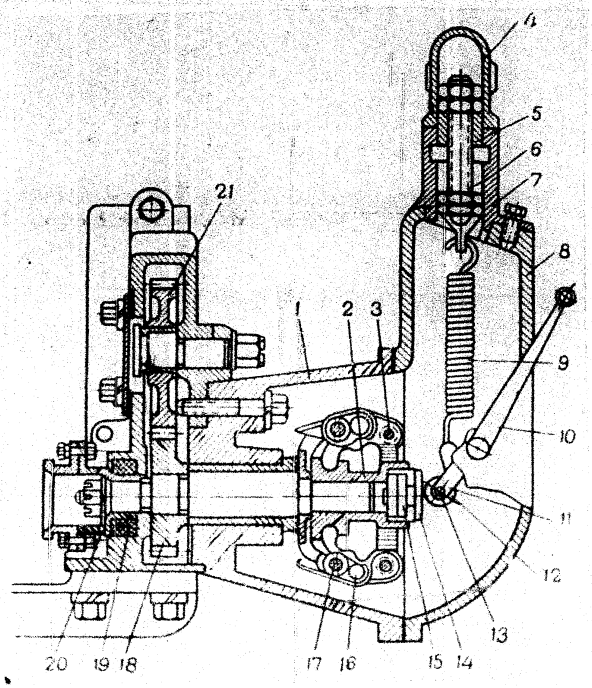


Fig.19:- R.p.m. governor.

1 - Casing of the governor, 2 - sliding sleeve, 3 - spring of the weight, 4 - governor spring tensioning mechanism body head, 5 - threaded bush of the regulating screw, 6 - spring tension adjusting screw, 7 - regulator spring tensioning of the pulling mechanism body, 8 - governor housing cover, 9 - pull-off-roller lever spring, 10 - throttle valve governor drive lever on pivot pin, 11 - governor pull off roller lever, 12 - governor pull off roller, 13 - governor pull off roller shaft, 14 - sliding sleeve thrustface, 15 - thrust bearing of the sliding sleeve, 15 - weight of the centrifugal governor, 17 - weight pivot, 18 - governor driven gear, 19 - stuffing box, 20 - stuffing box-retaining plate, 21 - intermediate gear.

The gear of the governor drive is taken off the camshaft gear of the engine. It is designed as follows: to the right front part of the engine block a housing with a pair of driving gears is bolted instead of the cover of the timing gear. One of the gears (intermediate) is placed on the shaft fitted in the wall of the housing meshes with the camshaft gear. The second gear meshing with the intermediate one is keyed on the drive shaft of the governor. The governor shaft r.p.m. is equal to the r.p.m. of the engine.

Throttle and choke valve control is performed by means of armoured cable from the central switch-board.

Moreover the armoured cables are fixed with clamps to the body front wall to the cover of the niche. One end of the armoured cable is fixed to the respective valve control levers, the other one to the button on the central switchboard.

Control of the choke valve is realized by means of a button with the inscription "AIR", which freely slides in a guide. The proper adjust control of the choke valve should secure its full opening when pushing the button to the stop. The control is adjusted by changing the cable length.

The control mechanism of the throttle valve consists of a special threaded bush, immovably fixed in the body of the switch-board, of a hand wheel, screwed into the bush and of a button with the inscription "GAS" and of an armoured cable. The lever is placed in the hub of the hand-wheel. The button stem is joint with the armoured cable and is axially freely movable. Rotating the hand-wheel countre clockwise cable drawnout the throttled valve closes. Rotation the hand-wheel clockwise the cable returns, forced by the spring into the original position opening the throttle valve.

The throttled valve is always fully opened when the hand wheel is fully screwed in and the button with the inscription "GAS" fully pulled in.

The correctly adjusted control of the throttle valve may secure minimum constant idling revolutions of the engine and operating revolutions of the engine under load. The control is adjusted similarly with the choke valve control adjustment.

Generator.

The generator set includes D.C. generator of the type PN 100 (Fig.20) of the output 10,5 kw, destined to produce electric energy, used for charging of starting storage batteries.

The maximum current, available from the generator is 85 A at a voltage of 125 V.

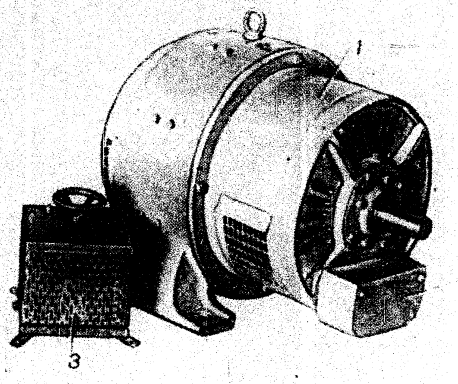


Fig.20: Generator PN-100

1 - generator,
2 - terminal box
3 - rheostat governor

Characteristics of the generator:

Type	PN-100
Exciting	compound
Kind of current	direct
Output, kwt	10,5
Rated voltage, V	115 or 120/200
Weight of the generator, kg	290
Starting rheostat	RV-6,5

The generator is a four polary electrical machine, consisting of a steel housing with four main and four auxiliary poles, an armature with a commutator and of a fan of a brush arm, of a front and back cover.

In the lower part of the back (hind) cover is box with 2 terminals. The winding terminals are fixed to pressed in contacts placed on the board, covered by a steel lid. On the wall of the lid is placed a table with the connection scheme.

The voltage of the generator is regulated by rheostat 3 of the type RV-6,5. The starting rheostat consists of separate wire resistances, ends of which are contacted to the contact plates, on which move the brushes of the slider. The wire resistances are fixed in an enclosed frame. The shirt is perforated for dissipation of heat produced by the resistances.

The starting rheostat is placed in the imovable part of the niche and is connected by wires with the shunt windings of the generator. The wires from the generator and from the engine ignition lead to the intermediate terminal box, fixed on the front wall of the body in the niche, where from they lead to the central switchboard.

Central switch board.

The central switch board (fig. 21,22) serves for the distribution of the electrical energy to consumer units of the workshop.

Instruments and devices on the central switch-board are fixed on a panel, which is fastened to the frame of the board by latches and four nuts. The frame of the board has a metallic cover from three sides. For vibration damping of the board between the frame and the panel rubber strips are inserted, The frame of the board is fixed on the front wall of the body.

On the panel of the switch-board are assembled:

1) Ampermater, type PN-70 for measuring intensity of the charging current of the generator G 20, with a dial 0-30.
2) Aero-thermometer for measuring water temperature in the cooling system.
3) Voltmeter, type PN 70, with a scale from 0-150 for measur tension on the terminals of the generator PN-100.
4) Watch
5) In the upper part of the panel under the cover are placed fuses of the type PR-1

Two left hand 100 A fuses are destined for protection of the generator from short circuiting and from overloading.

Four 60 A fuses are destined for protection of the charging unit circuits and No.1 and No.2 from short circuiting.

Two safety 10 A fuses are destined for protection from short circuiting of the 120 V socket placed above the left hand bench.

In the lower part of the board under the covers are placed two blocks of fuses of the low tension circuit.

The fuses of the left hand block are inserted in:

the first for 20 A in the circuit of an external 12V socket
the second for 10A for the lighting circuit of the niche
the third for 40A for the lighting circuit of the body
the fourth for 20A for the fan

The fuses of the right hand block are inserted in:

the first for 30 A in the charging circuit of the generator G/20
the second for 10A in the ignition circuit of the engine
the third for 140 A in the circuit of the baterry
the fourth for 120A in the circuit of the 12V socket, which is destined for switching of the electrical stabilizer

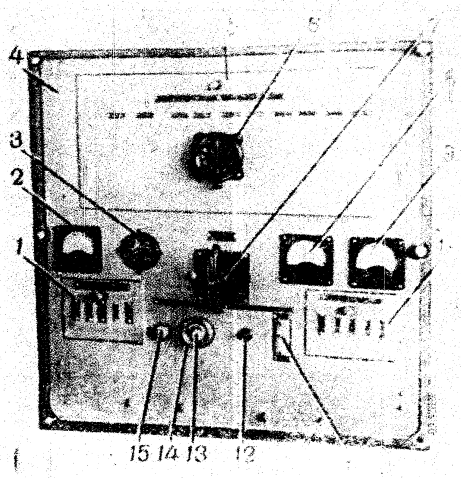


Fig.21: - Central switch-board (front view).

1 - boxes for 12V fuses, 2 - ampermeter of the generator for 12V, 3 - aero thermometer, 4 - instrument panel, 5 - box for 120 V fuses, 6 - watch, 7 - main switch, 8 - ampermeter of the generator 120 V, 9 - voltmeter, 10 - ignition switch, 11 - starter button, 12 - throttle valve push button, 13 - throttle valve control hand wheel instrument, 14 - choke valve push button.

Besides that in the lower part of the panel are placed the following push-buttons:

for starter switching
for throttle valve control
for choke valve control
for ignition switching

On the lids of the fuse boxes are fixed fuse-name plates with current indications.

Charging units.

The charging units is destinated for charging and discharging of starter storage batteries of all types.

Technical characteristics of the charging unit.

No. of group indices	charging unit No.1				charging unit No.2			
	1	2	3	4	5	6	7	8
charging current intensity A	4-8	9-18	9-18	4-8	6-12	8-16	8-16	0,5-2
maximum number of 12V batteries in series	7	7	7	7	7	7	7	7
minimum number of 12V batteries for charging of secondery current	4	3	3	4	2	3	3	1
maximum discharging current A	5	12,6	12,6	6	8,4	11,2	11,2	1,4
Total resistance of the rheostats, ohm	17^{+3}	7^{+2}	7^{+2}	17^{+3}	15^{+2}	10^{+2}	10^{+2}	190^{+30}
Resistance of one tube ohm	17^{+3}	$5,5^{+1}$	$3,5^{+1}$	17^{+3}	$7,5^{+1}$	5^{+1}	5^{+1}	190^{+30}
Diameter of nichrome wires of tthe rheostat, mm	1,8	3,0	3,0	1,8	2,3	2,6	2,6	0,8
length of nochrome wires, m	44	26,5	26,5	44	33	30	30	98

Outside dimensions , mm

	in mobile state	in working state
length	650	860
width	600	600
height	370	965

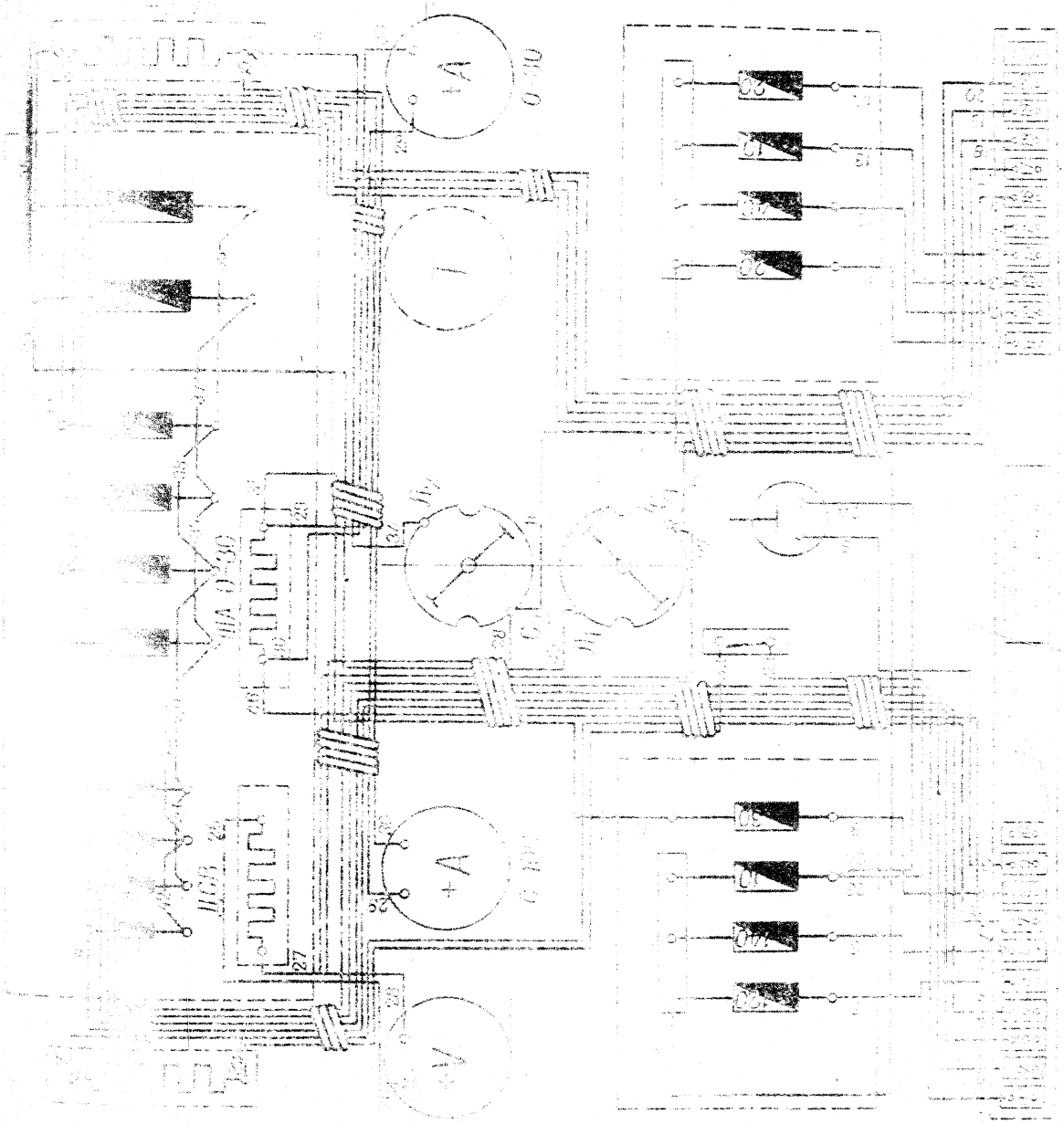
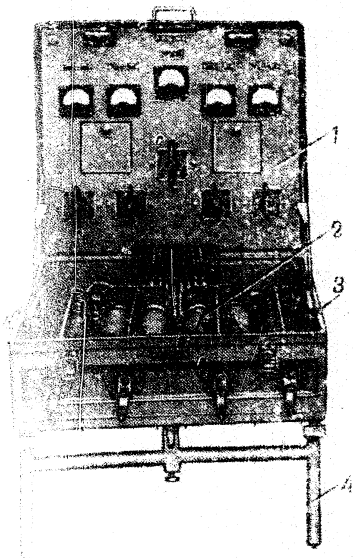


Fig. 22: - Central switch board (semi assenbled schemc)
The workshop has two charging- units of the portable type No.1 (Fig. 23) and No.2 (Fig.24).



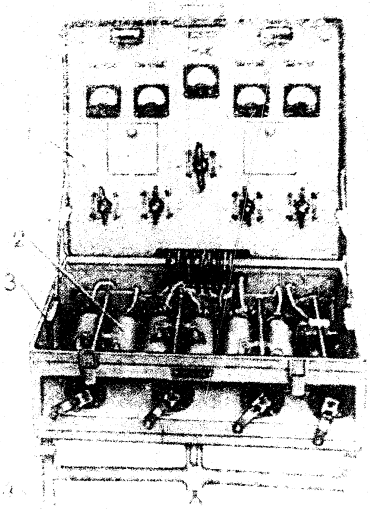


Fig. 23: Chargin_ unit (tot_l view) No.1
1 - panel, 2 - rheostat, 3 - box, 4 - support

Fig.24: Charging unit (totcl view) No.2.
1 - panel, 2 rheostat, 3 - box, 4 - support

Each charging unit consists of four charging-discharging groups which differ from each other by admissible charging-discharging current intensity. The weight of each charging unit is about 60 kg.

Charging or discharging the starting storage batteries can be performed in both of the illustrated units independently.

The minimum number of batteries, which cyn be charged at once (as shown in the chart) is determinated for the voltage 120 V. When lowering the voltage of the gemerator only one battery can be charged.

Each charging unit consists of a box, instrument panel and rheostats.

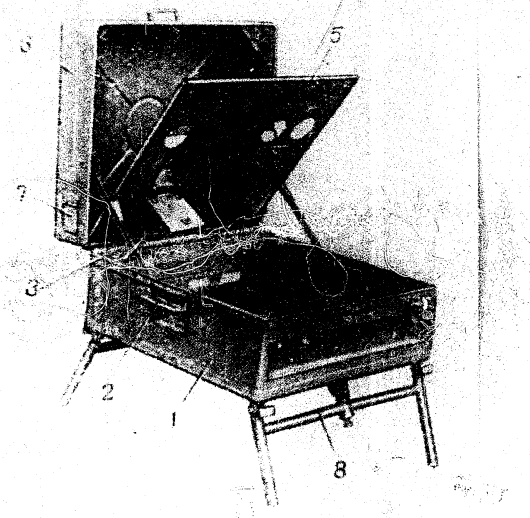


Fig. 25:

The charging unit box.

The charging unit box (Fig.25) contains the instrument panel and rheostat assemblies. The charging unit box consists of an upper and lower half, contacted by two hinges. The upper and lower half of the box are tightly closed by means of two locks and when opened are are held by two slide braces.

In the bottom of the lower half are openings for cold air, cooling the rheostats during the work of the charging unit.

In the front wall of the lower box half is a depression with openings for rheostat cranks, in the back wall is a depression for panels with contacts, which are connected with cable terminals of the storage batteries. Outside the box are welded to the bottom of the lower box two tiltable supports, which are held by spring devices. When the charging unit in operation the supports are expanded sidewards and are fixed by same spring devices.

On the right hand side wall of the upper box half inside is fixed a socket for engaging of the plug of the light cable and on the left hand side wall is fixed a socket for switching in a lamp 120 V.

On the panel (Fig.26 and 27) are assembled:

1) Two lamps of the type KIS 29 for lighting of instruments with light bulbs (28 x 5.). The electric light bulbs are arranged in series and switched in the circuit across a series resistance.
2) switch for lanterns KIS 39
3) four ampermeters for measuring of the current in the charging and discharging groups, two ampermeters with scales 20-0-20 A,

two ampermeters with scale 10-0-10 A for charging unit No.1
three ampermeters with scale 20-0-20 A and one ampermeter with scale 5-0-5 A for charging unit No.2

4) Voltmeter with a scale 0-150 V for measurement of the terminal voltage of the charging groups.
5) four fuses, type PR-1 for the protection of cables which are connected to the batteries from short circuiting. The safety are placed in two boxes, covered with metallic lids.
6) The main switch type PK-2/60 is placed in the middle part of the panel.
7) Four switches PK 2-25-N-2 are switched into the circuit of each charging-discharging group, they serve for s itching on or off of the groups for charging resp. discharging.

On the back side of the panel on special bracket are placed the reverse current relay for each charging group. The relay are destined for protection of the generator from reverse currents in case that the voltage of the generator is lower than the voltage of the batteries to be charged (i.e. in case of engine r.p.m. decrease or when stopping).

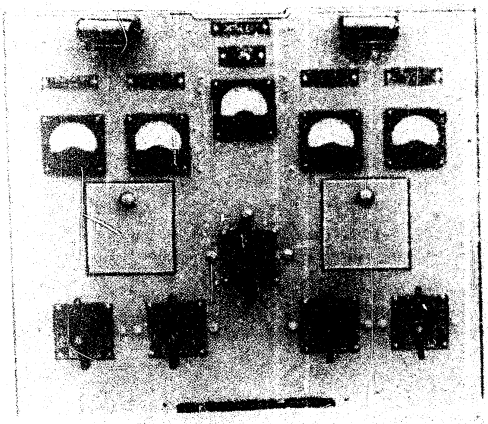


Fig.26: Panel of the charging unit (front view)

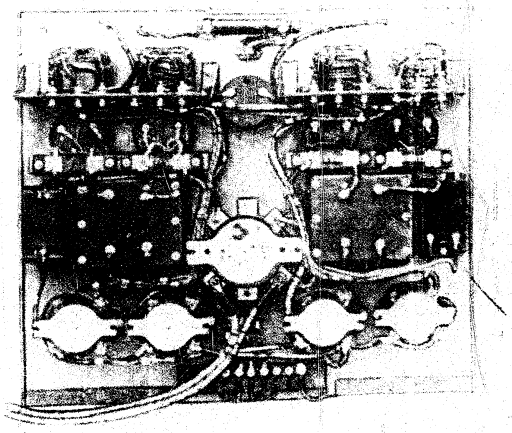


Fig. 27: Panel of the charging unit (rear view)

The working voltage of the reverse current relay is 24 V, therefore they all must be switched into the 120 V circuit from the generator PN-100 across the additional resistances of 170-180 ohm. Through the winding of each relay flows a current of 0,15-0,22 A

and across the additional resistance is adjusted to switch on at a voltage of 105-115 V and to switch off a voltage of 78-88 V. in the absence of the charging current in the serial winding.

The adjusted reverse current relais must switch off the charging groups according to the following reverse current valves:

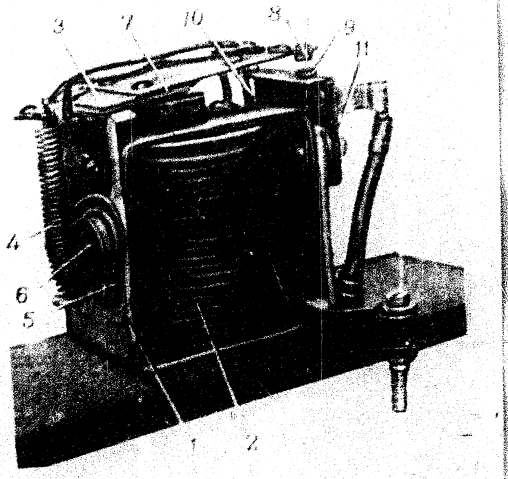
No. of group	1	2	3	4	5	6	7	8
Maximum switching off reverse current intensity of the relais.	0.8	2,5	2,5	0,8	2,5	2,5	2,5	0,4

The additional resistances of 170- 180 ohm consists of porcelain pipes, on which is wound a nichrome wore by Ø 0,4 mm and 25 mm long.

The reverse current relay (Fig.28) consists of a U yoke 1, of a round core 2, with a slided on bobbing with the shunted and serial windings of the armature 3, jointed with the yoke and of the spring 4, pulling off the armature from the core. On the side of the yoke is fitted a setting plate 5 with a setting bolt 6, destined for changing the tension of the spring.

On the armature is fixed a contact fork, on its projecting ends are two silver mobile contacts 8. Two screws fix two silver immovable contacts 9 to the yoke insulation plate. In the plate are cuts for setting clearance between the contacts.

Fig. 28:
1 - Yoke, 2 - core and winling, 3 - armature, 4 - spring, 5- setting plate, 6 - setting bolt 7 - fork, 8 - movable contact 9 - immovable contact, 10 - limiter, 11 - insulation plate.



The armature with the contacts is constantly drawn off a spring upward. The spring is fixed by one end on the end of the armature by the second one on the end of the setting plate.

For adjustment of the clearance between the armature and the core is a limiter 10, made in form of a frame. The air gap between the armature and the core with the contacts opened may be reduced or increased by bending the limiter. For easier work the armature is connected with the yoke by means of a cable.

The shunt winlings of all relay are of wire of the mark PEL, Ø 0,23 mm 195 mm long with 3300 and with a common winling resistance of 82 +3 ohm .

For the serial insulation is used the wire of the mark PEIBO. The serial winling are as follows:

type of relay	Ø wire mm	lenght m	Number of winling
20 A	3,05	4	25
8 A	1,81	8	80
4 A	1,25	16	175

The work of the reverse current relais is based on a reciprocal action of forces in the magnetic field of the serial and shunt winlings and of the spring.

When the charging unit and distributor set panel is showing a voltage 105- 115 V the external network is dead, the shunt winding is under the rpimary voltage. The shunt winling is designed so that the current creates a magnetic field magnetizing the core which attracts the armature and relay contact close.

The serial winding of the relay is connected in such a way that the charging current creates a magnetizing flow of the same direction as theflow in the shunt coil. This intensifies magnetizing of the core so that the armature is attracted by a great force to the core and the contact relay is closed reliably.

If the generator voltage is lower then the voltage of the storage batteries, this creates a reverse current in the serial coil and a magnetic flow of opposite direction to the magnetic flow in the shunt coil, the resulating magnetic flow is getting weaker, the core demagnetizes. The spring pulls the armature of the core and opens the relay contacts, i.e. it cuts off the external network and protects the generator from reverse current.

When discharging the batteries the reverse current relay does not work as it is switched off the network,

The rheostat (Fig. 29 and 30) in the charging-discharging groups serve for regulation of the charging - discharging current intensity when charging and discharging batteries.

For charging and discharging any number of storage batteries of different types in each charging unit are four separate rheostats The rheostats of the 1st, 4 th and 8th group have one porcelain pipe each and the rheostats of the 2nd, 3rd, 5th, 6th and 7th group has two porcelain tubes 5, each 440 mm long, Ø 60/50 or 60/40 mm. As rheostat resistance serves a nichrome wire of a corresponding diameter, wound on pipes.

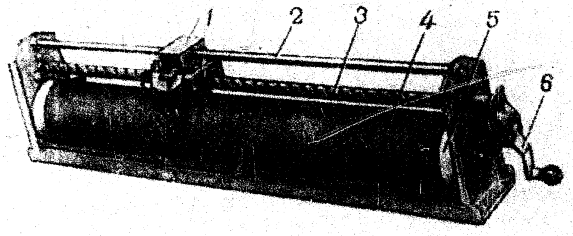


Fig . 29: Rheostat with the usual porcelain tube.
1 - slider, 2 - guide, 3 - drive screw, 4 - nichrome wire, 5 - porcelain tube, 6 - crank of rheostat

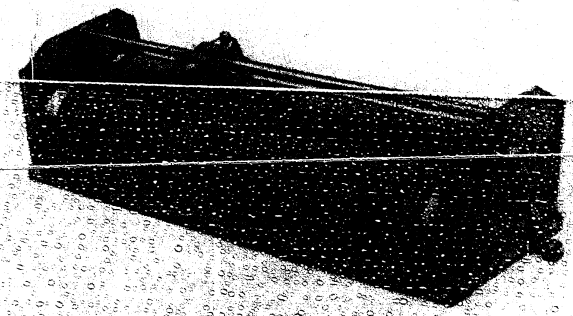


Fig. 30: Rheostat with the porcelain pipes.

For charging the resistance serves the lever 6, fixed on a square end of the drive screw 3. When the rheostat is out of action, the lever is folded.

In the rheostat with two tubes the guide is of steel and the current does not flow through it.

In the rheostat with one porcelain tube the guide is made of [illegible] and the current flows through it.

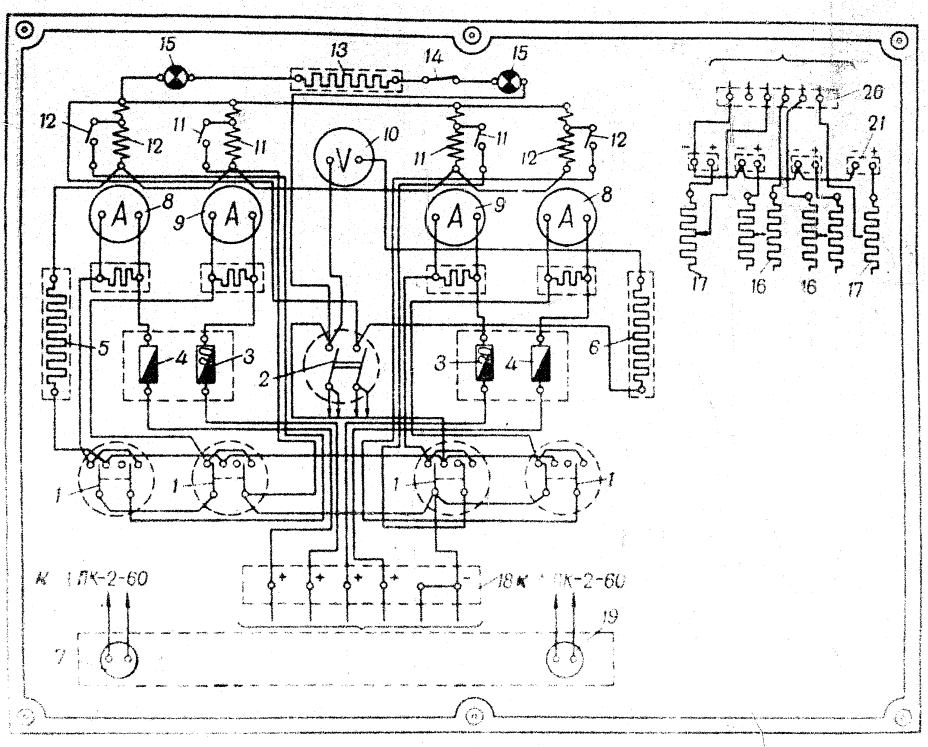


Fig. 31: - Wiring diagram of the charging unit No.1.
1 - switch PK-2-25-H2, 2 - switch PK-2-60, 3 - fuse PR-1 for 60A 4 - fuse PR-1 with a mounting 10 A plug, 5 - additional resistance of reverse current relay, 6 - additional resistance of the voltmeter, 7 - distributor socket plug, 8 - ammeter PM-70, 10.0. 10 with shunt, 9 - ammeter PM 70, 20-0-20, 10 - voltmeter PM-70 0- 150 V, 11 - relay of reverse current 120 V, 25 A, 12 - relay of reverse current 120 V, 8 A, 13 - lamps resistance, 14 - switch V-45, 15 - panel light, 16 - rheostat for 18 A, 17 - rheostat for 8 A, 18 - panel terminal board, 19 - panel socket, 20 - casing terminal box, 21 - contact

When slider 1 of the rheostat is in the rear end position, the rheostat resistance is practically zero and in the front end position the resistance is at the maximum.

The charging unit (Fig.31 and 32) is fed from the generator set through cable plug socket onnthe upper halves of the boxes.

Installation of the charging unit panels is done by means of flexible AOL or LPRGS cables and connection of the rheostat with copper wire lead through porcelain isolators.

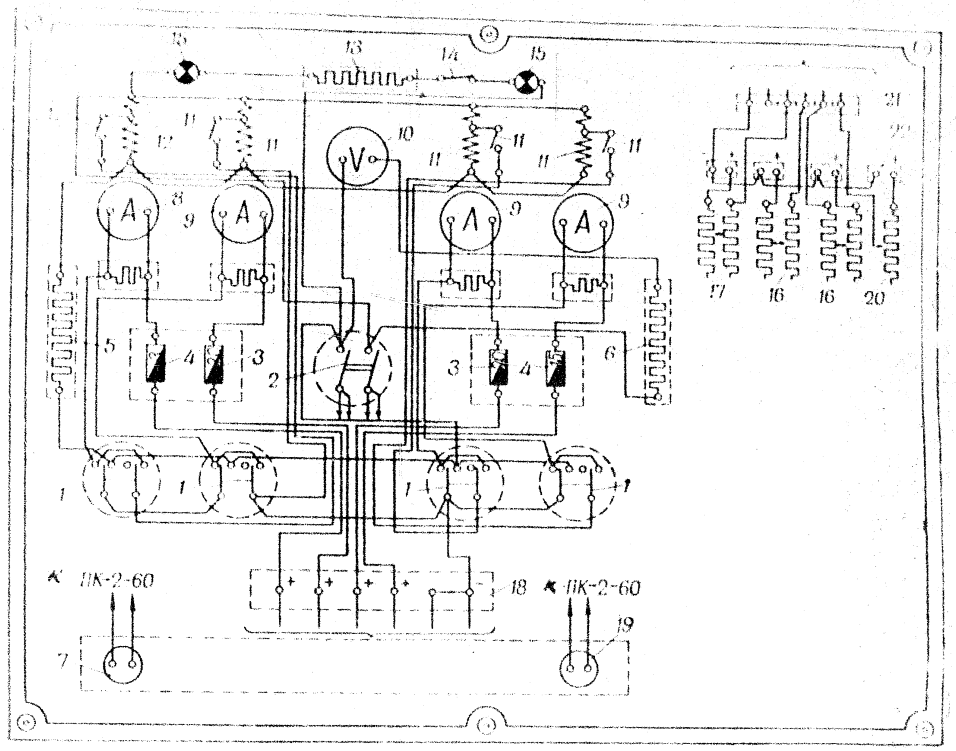


Fig. 32:- Wiring diagram of charging distributor set No.2.
1 - switch PK-2-25-H2, 2 - switch PK 2-60, 3 - fuse PR-1 for 60A 4 - fuse PR-1, 15 A, 5 - additional resistance of reverse current relay, 6 - additional resistance of the voltmeter, 7 - distributor socket plug, 8 - ammeter PM 70 20-0-20 with shunt, 9 - ammeter PM 70, 20-0-20 with shunt, 10 - volt meter PM 70, 0-150 V, 11 - relay of reverse current 120 V, 25 A, 12 - relay of reverse current 120 V, 4 A, 13 - lamp resistance, 14 - switch B-45, 15 - panel lighting lamp, 16 - rheostat for 16 A, 17 - rheostat for 12 A, 18 - panel terminal board, 19 - plug socket, 20 - rheostat for 12 A, 21 - casing terminal box, 22 - contact panel.

The current flows from plug socket to lower contacts of the PK-2-60 switch to which are switched the wires from the socket of portable lamp. The portable lamps may therefore be lit regardless of the switch main layer position of the charging unit.

When the main switch is switched on the current from the plus terminal flows in two directions: to the voltmeter through its additional resistance and to the reverse current relay.

The current from the reverse current relay terminals is flowing in two directions: through damping resistance and switch to the

panel lighting bulbs and when the switches are switched on for charging through series and shunt coils of the reverse current relay, through additional relay resistance, switches of the charging groups, ampermeter shunts, fuses, terminal boards rheostats and panel terminals storage batteries. To the minus terminal of the main switch the lead terminals from the voltmeter, lighting bulbs and the group, switches of the charging groups are connected. A minus cable is leading to the panel where all minus terminals are connected.

In each group there is a charging and discharging network, which can be switched on by charging position of the switch lever.

With the upper position of the switch lever the charging network and with the down-position the discharging network is switched on.

When discharging, current from the plus terminal of the batteries, is flowing through the rheostat, rheostat slider, fuse and amperemeter shunt to the group switch, through its contacts to the minus terminal on the panel and to the minus terminal of the storage batteries. Thereby the amperemeter pointer deviates in the opposite direction according to the reverse current in the network.

Turning the switch lever to the right or left, the group is switched off.

External plug sockets assembly.

The assembly of external switch-plug sockets (Fig.33) consists of two special plug sockets 120 V, 50 A for switching of the charging unit and of one plug socket of 12 V for switching in the portable lamp.

On the neck of the 120 V switch is a screw thread for screwing on of cap nuts of the plug coupling 4 (Fig.34) of feeding cables of the charging unit. When the cables are out of engagement the plugs sockets are covered with screwed on special lids 1 (Fig.33), protecting the plug-contacts from mechanical damage, from penetration of moisture, mud and foreign matter, which may provoke short circuiting.

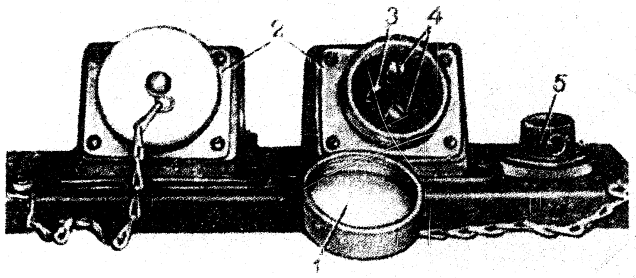


Fig. 33.-External plugs-socket assembly.
1 - lid, 2 - 120 V socket plug, 3 - guiding plug, 4 - contacts plugs, 5 - plug socket for 12 V.

In each plug are two brass plug contacts 4 and one steel guide plug 3, which secure polarity of the engagement.

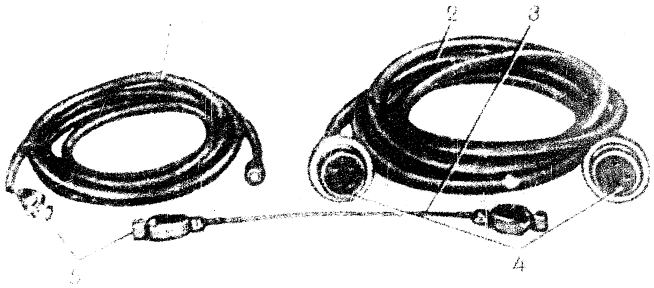


Fig.34.- Connection cables and wires.
1 - cable for connecting the charging unit to the storage batteries, 2 - cable for connecting charging unit to the plug sockets assembly, 3 - connector for interconnecting of storage batteries, 4 - plug coupling, 5 - clamps

Tents.

The tent (Fig.35) is destined for placing in the charging unit building table and storage batteries during their charging and discharging.

Dimensions of the tent: 3.660 mm width, 4.500 and height 2700mm / 2000 mm.

The tent is rectangular tarpaulin tent, to which right and left side walls are sewn. In the side wall of the tent three windows are cut, in both left and right walls is one window cut. The window openings (in case of necessity) can be provided with celluloid panes.

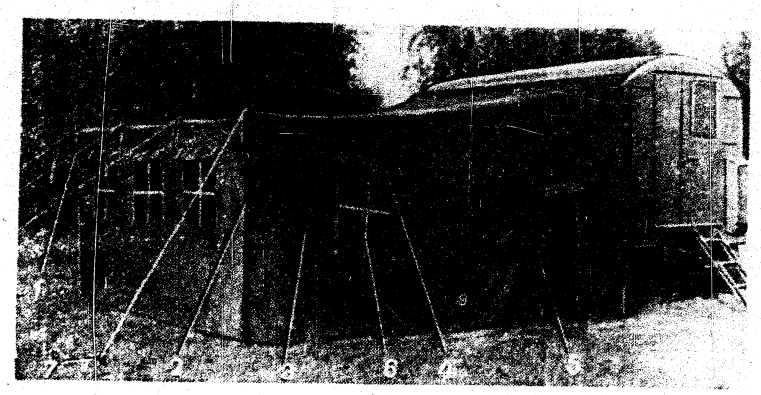


Fig. 35: Tent.
1 - stretching ropes, 2 - metallic tabular posts, 3 - tent tarpaulin , 4 - window blind, 5 - door, 6 - celluloid removable window, 7 - main stake.

In the mobile state the window are placed in a tarpaulin cover, which is hung in the body on the front wall of the niche. In the left and right walls of the tent near the body a door with foldback tent is provided.

The complete tent assembly includes metallic tabular posts, 2,2 mm high; they are destined for supporting the side wall and for stretching the tent. The pointed end of the post is driven into ground, on the other end is a plug, which is introduced into the opening of a leather reinforcement of the cover. The plugs of the posts, when they are placed in the tent, are provided with wooden extensions, to which are fixed the loops of stretching ropes, which are connected to the main stake driven into the ground.

Moreover, the complete tent assembly includes four large and 22 small stakes with welded on cross pivots for the fixing of tent stretching.

During prolonged standstill periods of the workshop, the tent is to be kept in the body.

Benches.

In the body are placed two benches (Fig.36), which are destined for arrangement of the equipment and storing of tools, instruments, accessories, materials and spare parts.

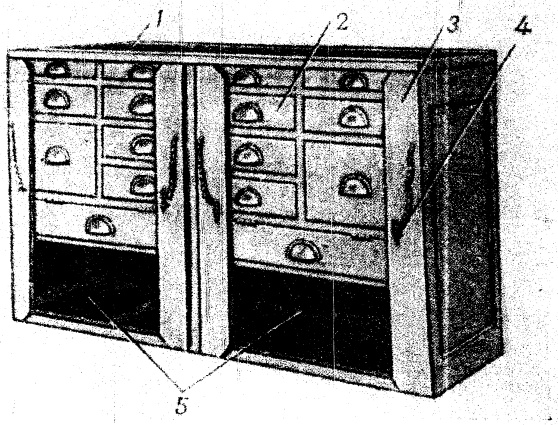


Fig. 36- Bench

1 - upper desk, 2 - drawers, 3 - wooden flap, 4 - metallic joint pin, 5 - niche for placing of the charging unit and vessels

Exterior dimension of the benches: length 1460 mm, width 606 mm, height 900 mm.

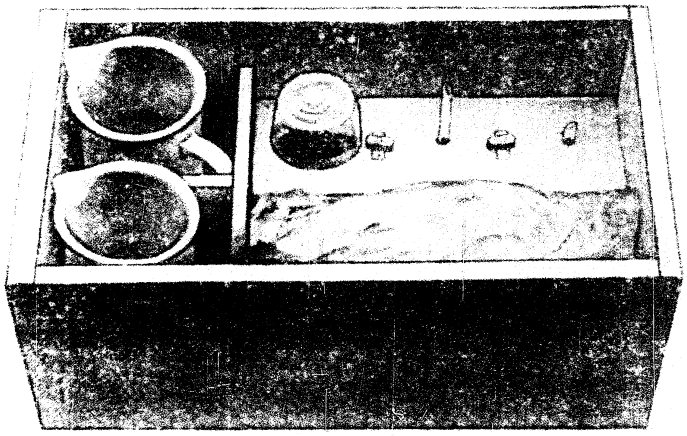


Fig.37:- Storage of porcelain and glass plates and dishes in the drawer.

The benches consist of a frame, upper desk and drawers .

In the lower part of the left bench are arranged two opened niches for placing the charging unit and in the lower part of the right hand bench are two opened niches, for placing three containers and one tank and two closed niches for placing electric cables of the charging unit and connectors for interconnecting the batteries in groups.

On the Fig. 37 -40 is shown the arrangement of tools and accessories in drawers.

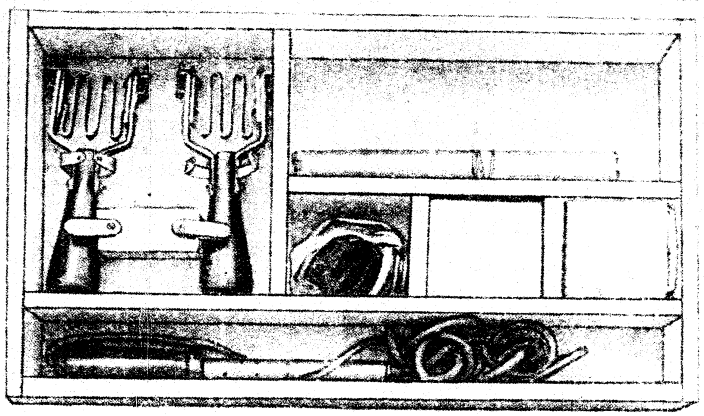


Fig. 38. Storage of the fork and solder iron in the drawer.

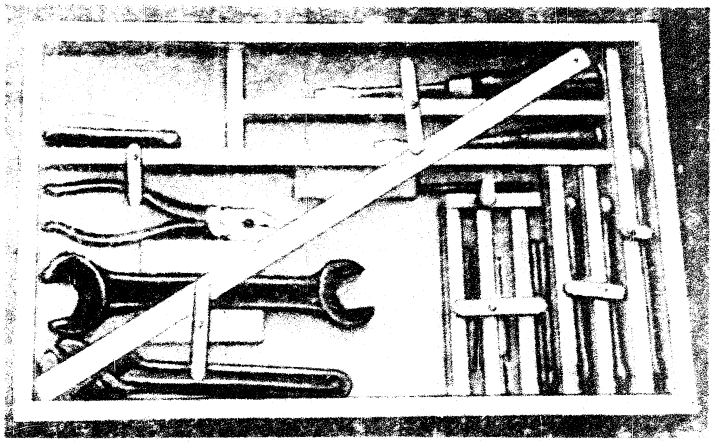


Fig. 39: - Arrangement of the tools in the drawer.

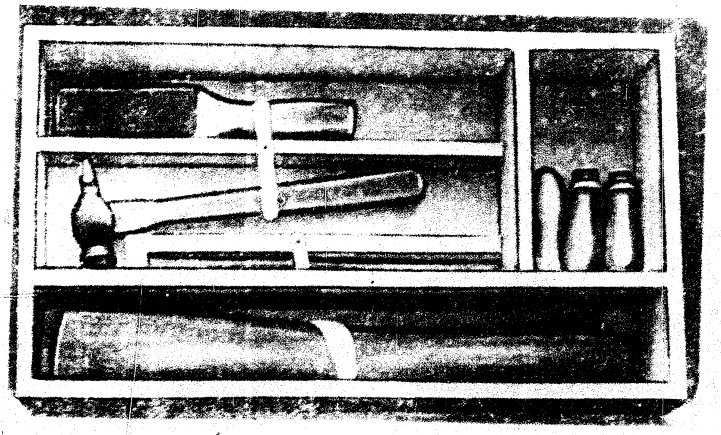


Fig. 40: - Arrangement of tools in the drawer.

Chest for bottles for storage battery

The chest has a wooden frame covered with ply-wood. Its dimensions are: height 605 mm, width 346 mm and depth 346 mm.

The cover of the chest is hinged and opens upwards. To prevents self-opening when driving it is secured by two hooks. Inside the chest are two holder blocks lined with felt. In the blocks are openings corresponding to the bottle dimensions. The bottom of the chest is covered with felt to prevent the bottle from breaking.

Cupboard for household utensils.

The cupboard is destined for storing the sleeping hammocks, washstand, first-aid outfit, drink-water tank, gasmasks, rubber boats and personal things of the crew.

Overall cupboard dimensions are: length 600 mm, width 500 mm and height 1420 mm.

Ventilator.

The ventilator is destined for ventilating the body of the shop. The ventilator consists of a body, electric motor, fan and cowl.

Data of the ventilator.

Electric motor ..... MV - 42
Rated voltage V..... 24
Rated input wt..... 175
R.p.m. under load a voltage 12V about..... 1500
Diameter of fan mm---..... 320
Direction of rotation..... right hand

From the outside of the body the opening for the fan is covered by a special cowl.

The fan is started by means of a switch placed on the front wall beneath the fan.

IV. Special equipment.

Electric distillation apparatus.

The electric distillation apparatus (Fig. 41, 42) serves for producing distilled water.

Data of distillation apparatus:

Tank capacity.l..... 8
Output l/h..... 1,5
Output of electrical heating element,watt...1300-1500
Voltage V..... 115-120

The distillating apparatus consists of bottom part, lower tank, upper tank, cover, cover-collector and heating element.

The heating element is made of nichrome or FeCrAl- alloy-wire threaded through porcelain isolating heads. The ends of the wire are connected to contacts on a porcelain block. To the contacts of this porcelain block are also connected the ends of a line which passes through porcelain bushes arranged in the bottom part of the distillating apparatus. The line has on its end a plug for connection with the current source. On the disk are placed two layers of asbestos on top of which the heating element with the porcelain block is located. The disc together with the heating element is mounted in a recess of the bottom of the lower tank and is held in place by a spring ring. In the centre of the disc of the heating element is a recess which houses a bolt secured to the disk by a nut. On the end of this bolt is fixed the bottom part of the apparatus which is secured by another nut. The lower tank is fitted with water gauge 2 (see Fig.41), drain cock 1 and inlet fitting 7.

The cover collector serves for collecting condensed water and has the form of a bevel cone. It is fitted with a tube through which distilled water is drained. Under the cover-collector is mounted a separator.

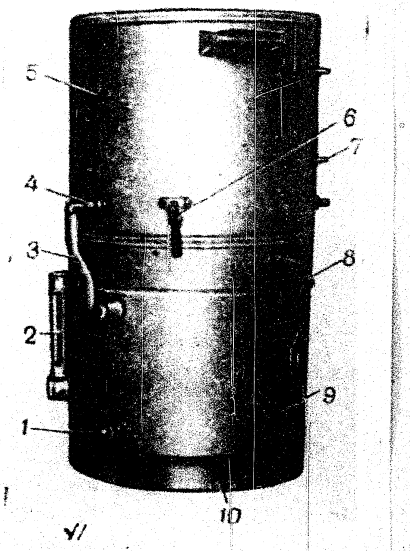


Fig.41:
Electrical distilling apparatus.
1 - drain cock, 2 - water gauge, 3 - rubber tube, 4 - by pass cock, 5 - upper tank, 6 - clasp hook 7 - inlet fitting, 8 - cock for draining distilled water, 9 - lower tank, 10 - bottom

The upper tank is fitted with a by-pass cock 4, which is connected with the inlet fitting of the lower tank through a rubber tube, inlet pipe 4 (see fig.42) and drain pipe 5 through which surplus water is drained. When working without flowing water the

ends of the pipes 4 and 5 are connected by means of a rubber tube. The upper tank is covered with a cover and fastened to the lower tank by means of three hooks. Between the tanks a rubber packing ring is inserted.

The distilling apparatus standing on a special frame with a steel-asbestos insert in placed on the right hand bench. The steel-asbestos insert protects the bench from excessive heating.

Among the spare parts of the shop is a spare heating element. For the work of the distilling apparatus it is necessary to fill the upper tank with clear water, open the by-pass cock and fill the lower tank up to the upper mark of the water gauge (8 litres). There after the upper tank must be refilled up to the upper drain pipe.

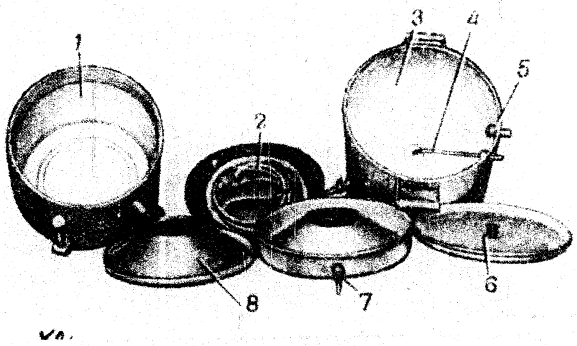


Fig. 42:- Dismantled electric distilling apparatus.
1 - lower tank, 2 - heating element and metal disk, 3 - upper tank, 4 - inlet pipe, 5 - drain pipe, 6 - cover, 7 - cover - collector, 8 - separator.

Slide a long rubber tube over the pipe of the cover-collector and insert its other end into the filling neck of the tank or of a bottle for distilled water.

Insert the plug of the line of the heating element of the distilling apparatus into the 120 V socket.

After 40-50 min. the water in the lower tank starts to boil and steam reaches the bottom of the upper tank filled with cold water. Here the steam condenses into water which flows off from the cover of the collector through the rubber tube into a tank or a bottle.

During the work of the distilling apparatus it is necessary to observe the level of the water in the lower tank. When the water level drops to the 4 l mark of the water gauge the ba-pass

cock must be opened and the lower and upper tanks filled up with water as said above.

If the water in the upper tank gets too hot it must be replaced by cold water.

Attention must be paid to the fastening of the ends of the line to the contacts of the distilling apparatus they must be tightened from time to time so that always a good electric contact is ensured. When tightening the nuts it is necessary to prevent the outlet contact from turning otherwise the wire of the heating element may break.

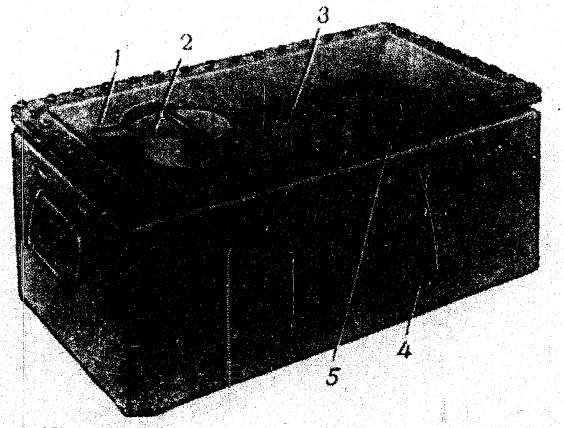
Periodically (at least once a month) the distilling apparatus must be dismantled, washed and the upper and lower tanks cleaned from scale and sediments.

If there is water piping near the shop the cock of the water piping may be connected by means of a rubber tube to the lower pipe of the upper tank. Remove the connector tube from the upper pipe and slide on it a longer tube the end of which passes out. Let the water run and regulate its quantity so that it flows away through the upper pipe without overflowing the upper tank.

Vessels for storage and distribution of electrolyte and distilled water.

Tanks (Fig.43) for the storage of electrolyte and distilled water are made of steel sheets and consist of body and cover with filler plug.

The inside of the tank is lined with rubber layer to protect it from corrosion by the accumulator acid.



V2

Fig. 43: - Tank for the storage of the electrolyte or distilled water.
1 - plug lock, 2 - plug, 3 - cover, 4 - tank, 5 - rubber layer

The cover has a filling neck which is shut by an ebonite plug 2. The plug is secured by a special lock 1. When the lock is closed its jaws engage into lugs welded to the neck and press the plug down. Between the plug and the neck is a rubber gasket.

The outside of the tank is pointed with gray acid resistant enamel point.

After every use the tank must be wiped with clean cloth soaked with a 10% solution of sodium bicarbonate and the metallic parts of the fastener must be smeared with vaseline or solidol to protect them from destroying.

To protect the rubber lining from destroying it is forbidden to fill the tanks with electrolyte of a density higher than , 38 or clean undilutated accumulator acid.

The temperature of the electrolyte must not exceed 60°C, because higher temperature would destroy the rubber lining.

The vessel for prepairing the electrolyte is of the same construction as the storage tank for the electrolyte, but the cover has no filling neck and is fastened to the vessel by twelve bolts.

When prepairing the electrolyte the cover is removed.

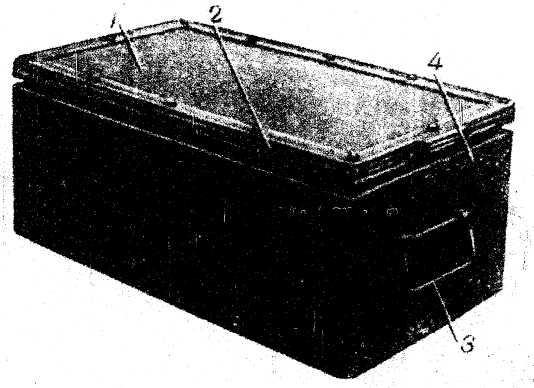


Fig. 44: - Vessel for prepairing the electrolyte.
1 - cover, 2 - rubber layer, 3 - handle, 4 - vessel

The same vessel may be used for soaking with alcaline solution or acid and washing out wooden separators or accumulator plates.

After every use the vessel must be wiped with cleaning cloth soaked with 10% solution of sodium bicarbonate.

The distributor (see Fig.45) serves for pumping electrolyte and distilled water from the tanks into the storage batteries.

The distributor is housed in a wooden box. It consists of a pump 7, reducer 6, with a drain valve, two rubber hoses 4, plug 3 with

fittings and endpieces 5. All details which come into contact with electrolyte are made of ebonite.

When using the distributor it is necessary to remove the plug from the neck of the tank, insert instead of it the plug with the fittings and rubber hoses. Secure the plug the lock. Shut the drain valve of the reducer and pump air into the tank. Insert the ebonite end piece with the hose into the accumulator battery or an other vessel and turn the head of the end piece. Electrolyte or water will then flow from the end-piece. When the level of the fluid in the tank drops it is necessary to make 2 - 3 strokes with the air pump.

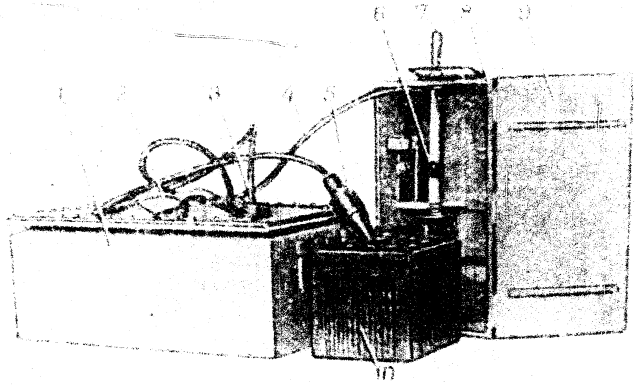


Fig. 45: - Electrolyte distributor apparatus.
1 - tank, 2 - lock, 3 - plug of the distributor, 4 - hose,
5 - end-piece of the distributor, 6 - reducer, 7 - pump,
8 - chest, 9 - chest cover, 10 - storage battery

The electrolyte will not flow if the plug is improperly tightened and air is leaking, in this case it is necessary to tighten the plug or insert a rubber packing ring under it.

Jig for extracting of plated groups and covers of onecell batteries.

The jig (Fig.46) serves for extracting of plate groups from cells of storage batteries, when these being dismantled. The jig is a special double scissors type extractor. To the ends of the double arm levers are welded sharp-edge jaws.

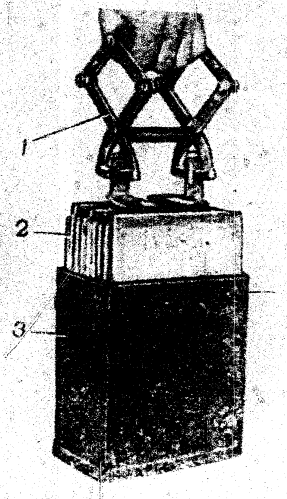


Fig. 46: - Jig for extracting of plate groups.
1 - jig for extracting of plate groups, 2 - packet of plate-group, 3 - ebonite container

Two types of jigs for extracting of plate groups are made. One for extracting of plate groups from storage batteries of all types used in tanks and motor-cars for starting the engine. The other from the storage batteries of motor-cycles.

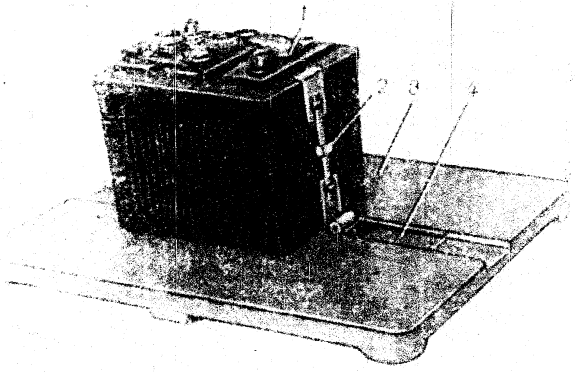


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Fig. 47: - Storage battery fastened to the board.
1 - storage battery, 2 - clamp, 3 - board, 4 - guide

Prior to extracting of plate groups it is necessary to prepair the storage battery for dismantling: discharge it, drain the electrolyte, remove the cell connectors, the sealing compound and the cell covers. The jig is applied on the terminal posts and the plate group is lifted.

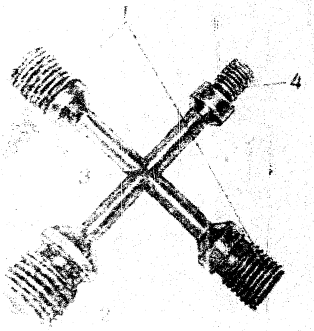
After use the jig must be wiped with a piece of cloth soaked with 10% solution of sodium bicarbonate. Then it must be wiped dry. During longer storage all parts of the jig must be lightly smeared with vaseline or solidol.

The board (Fig. 47) serves for fastening of the storage battery when the plate groups are to be extracted. The board has a groove with a metallic guide in which slide clamps with gripping lips.

The storage battery having been prepaired for dismantling is put on the board, the clamps are applied to the edges of the container of the wood box and tightened by turning the screw.

Then apply the extractor jaws to the terminal posts and resting with feet on the board remove the packet groups from each cell.

Fig. 48:-Jig for extracting the covers of single-cell storage batteries.



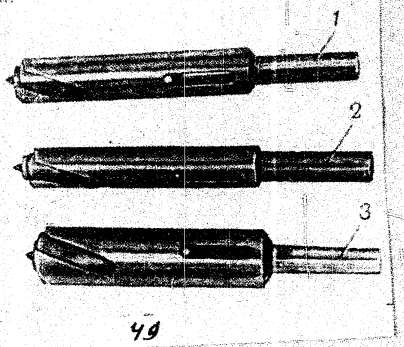
1 - plugs for covers of single-cell storage batteries 6-STEN.140 M, 2 - plug for covers of storage batteries 3-STE-80, 3 - STE-100, 3-STE-112, 3 - spider, 4 - plug for motorcycle storage batteries

The jig (Fig. 48.) serves for extracting the covers of storage batteries, which have threaded holes for the plugs. After removing the sealing compound from the cover screw the plug into the threaded hole and remove the cover from the ebonite container.

Jigs and instruments for mechaning and casting of lead parts.

Tubular drills (Fig.49) are intended for drilling off the cell connectors when dismantling accumulator batteries. The station id equipped with drills for storage batteries 6 STEN-140M as well as for other types of vehicle batteries.

Fig.49:- Tubulars drills. 1 - drill for storage batteries 6-STEN-140M 20 x 16 mm, 2- drill for accumulator batteries 16 x 12 mm , 3 - drill for accumulator batteries 14 x 10 mm.



49

For work the clamp drill in the belly brace 1 (see Fig.50), smear the stem with solidol or oil. Then drill a hole in the centre of the terminal post of 4 mm diameter and 4- 5 mm depth. Apply

the centre of the tubular drill into this hole drill off the terminal post.

Molds (Fig. 51) are intended for welding on the positive and negative posts of vehicle storage batteries.

Slip the mold over the worn out post and melt the lead of the post by means of a carbon electrode until the mold is quite full. If the mold is not quite full it is necessary to add lead. When welding is done remove the mold and file the post with a rasp file to the proper height.

Stampers (Fig.52) serve for making signs "+" and "-" on the terminals or posts of storage batteries. Apply the stamper with the required sign on the terminal and make a mark by striking it with a hammer. The sign "+" is to be filled with red paint.

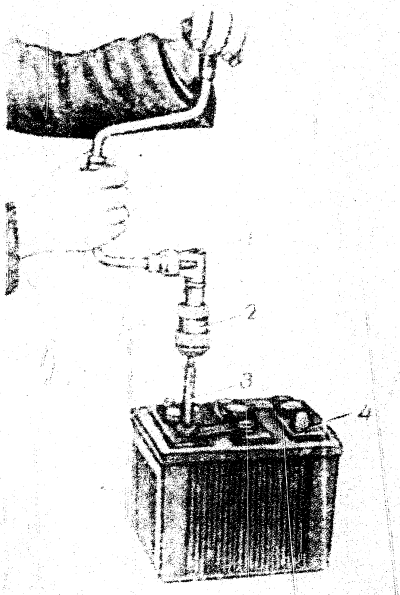


Fig. 50: - Drilling off cell connector.

1 - belly brace, 2 - chuck, 3 - tubular drill, 4 - storage battery

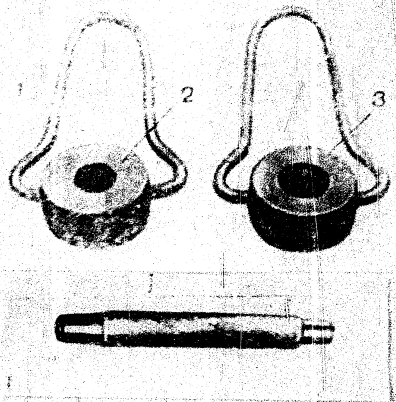


Fig. 51: - Mold for welding on of posts.

1 - handle, 2 - mold with sign"-" 3 - mold with sign "+"

Fig. 52: -Stamper.

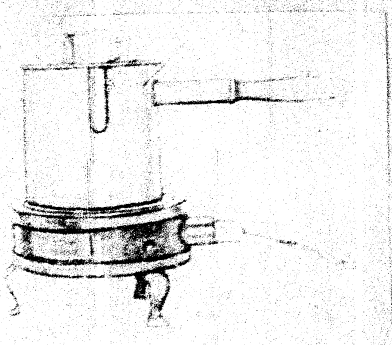


Fig. 53: - Ladle for melting lead and warming-up the sealing compound.

1 - cover, 2 - handle, 3 - electric stove, 4 - handle

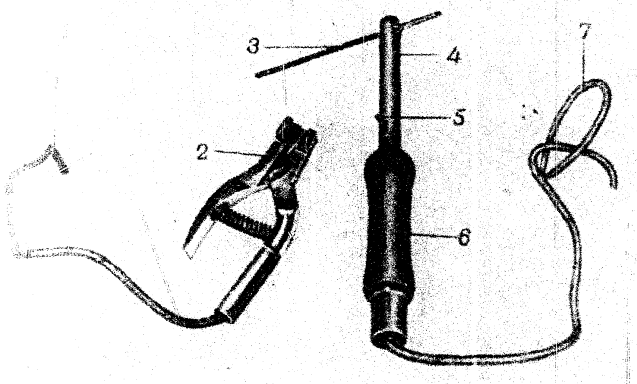


Fig. 54: Holder of the carbon electrode.
1 - lead of the clamp, 2 - assembled clamp, 3 - carbon electrode, 4 - tube, 5 - pin, 6 - handle, 7 - lead of the holder.

The holder of the carbon electrode (Fig. 54, 55) is destined for soldering lead parts when repairing or assembling the storage batteries. The holder set includes the holder with leading cable and the clamp with leading cable.

The holder consists of a tube with a wooden handle. At one end of the tube is a hole for the carbon electrode, the other end is threaded and a cap with a contact is screwed on it. In the tube is a rod and a spring which pushes it forward. The rod is held in the tube by a pin. By means of this pin the rod can be drawn back.

The lead passes through the cap and is soldered to a contact bush which is pressed by the cap against the tube thus a good electric contact with the tube is secured. The other ends of the leadings are joined in a common plug.

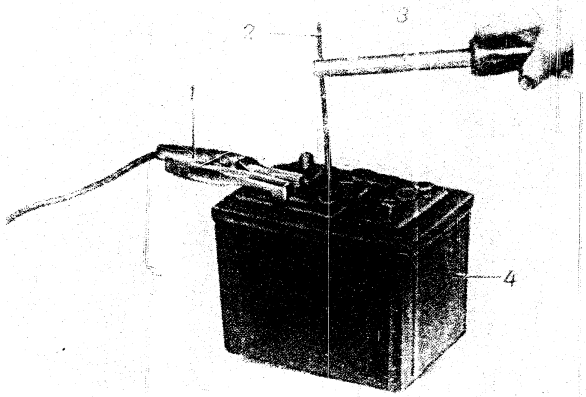


Fig. 55: - Soldering of the connection between the elements by means of carbon electrode holder.

1 - leading with clamp, 2 - carbon electrode, 3 - assembled holder, 4 - storage battery

Prior to soldering it is necessary to insert into the holder a carbon electrode of 6 - 8 diameter, backing the rod. The carbon electrode must protrude at least 100 mm.

Insert the plug into a socket and apply the clamp to the part which is to be soldered or to the base of a universal lead.

Touch with the carbon electrode the part which is to be soldered thus forming an electric arc which will melt the lead. Then submerge electrode a little into the molten lead and continue soldering melting simulatneously the lead of thepart and that of the added lead solder.

It is necessary to remember that the shorter is the working end of the electrode and the deeper it is submerged into the molten lead the greater is the current consumption during soldering and the discharging of the storage batteries,

During normal soldering (by means of a 12 V storage battery) the current intensity must be 40- 50 A. If the electrode is short and is deeply submerged into the molten lead the current intensity can reach 100 A. More over in this case the dectrode will be red hot and burnt quickly. A certain skill is therefore necessary for good and economic soldering.

When using the carbon electrode holder care must be taken not to touch the clamp with it and to avoid closing the circuit between the holder and the clamp across the soldered part, metallic armour of the bench or metallic ladle, because this will entail damage of the station equipment.

It is recommended to let the engine of the generator set run during soldering in order to prevent the accumulator battery from discharging too much.

Electric soldering iron ET-K (Fig.56) is destined for soldering lead on lead details having small defects, for heating and removing of the sealing compound during dismantling and for smoothing cracks in the seal when repairing storage batteries. The soldering iron has three exchangeable tips one ofwhich is shove shaped.

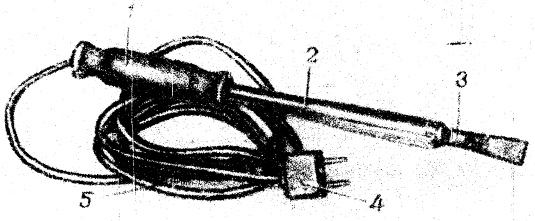


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Fig. 56: - Electric soldering iron.
1 - handle, 2 - tube, 3 - tip, 4 - plug, 5 - lead

The electric soldering iron is switched into a 120 V circuit and consumes 80 watts.

V. Work and servicing of the work shop.

Placing of the work-shop.

The station should be placed on the level ground, if possible, (Fig. 57) near a source of water (river, lake, pond or in inhabited places near a water-supply or a well).

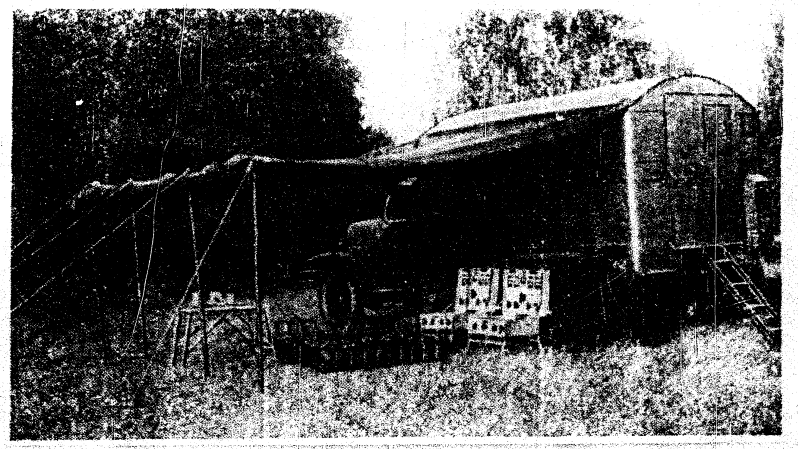

Fig. 57: - Unrolled tent for work in the summer.

To the left of the truck-car the ground must be levelled and there the tent is to be raised.

In the tent put on the ground pairs of wood planks on which the storage batteries are placed.

In the tent are also placed open boxes of the charging and discharging units and unfolded table, on which the accumulator batteries are anspected, received, repaired and distributed. Near the niche of the right side of the truck body drive into the ground the earthing pin and join its lead to the wing nut on the bracket of the right side fuel tank. Pour water on the ground around the grounding stock. Connect the charging and discharging unit to the block of external sockets by means of joining cables. Put the storage batteries which are to be charged on the planks, arrange them into groups and connect them with the corresponding terminals of the charging and discharging unit. Fill the engine of the generator set with water, oil and start it. When the engine being warmed up set its revolutions and the voltage of the generator PN-100, switch on the main switches on the central switchboard and on the panels of the charging and discharging unit and successively the group switches of the charging and discharging unit regulating the intensity of the charging or discharging current by means of rheostats.

When the charging or discharging of the storage batteries is finished switch off the group switches and the main switches of the charging and discharging unit, reduce the revolutions of the engine, switch on the rheostat of the PN-100 generator exciter switch off the switch on the central switch board and stop the engine.

Raising and pulling down of the tent is done by the whole crew of the station.

For raising the tent it is necessary: to loose the belts and take the tent down from the truck, unclasp the belts and withdraw the tent of the bag. Then fasten the tarpaulin to the hooks on the left side of the truck body by means of a spedial fork and the side walls to the side of the truck. Unscrew two wing nuts of the plank holding the tubular posts and take them out. Assemble the four posts, insert them into the holes in the tent, stretch the tent, mark on the ground the places where the lower ends of the posts are to be erected, dig holes in the ground and erect the posts.

Slip wooden endpieces on the upper ends of the posts. Put the slings of rope in the wood endpieces, drive into the ground stakes at a distance of 1,5 - 2 m from the posts and bind the rope to them.

Fasten the apron to the hooks of the protection coil of the motor- truck body, fasten the buckles at the corners and on the door and bind the tapes of the side walls to the posts.

Fasten the hooks of the span bands to the brackets which are welded to the posts, span the bands and fasten the buckles.

Put the windows into the openings of the tent. Span the left, right and side wall of the tent with the help of small stakes.

If the ventilation is insufficient release the left wall from the post and roll it up or take out one or even two windows.

The folding of the tent is done inversely. The folded tent is put into the bag. The long flaps are shut first, then are shut the narrow flaps. Clasp the short belts, then draw the long belts under the short and clasp their buckles. The packed tent is put on the spare wheels between the driver's cabin and the body of the truck and is secured by belts.

The stakes of the tent are put into tarpaulin folds and put into the proper place.

The posts are dismantled put in their bracket, the plank being fastened by means of wing nuts.

The metal stakes must be wiped after their extraction from the ground and lightly smeared with solidol.

Servicing of generator set.

To prepair the generator set for work:

1) Check the resistance of the insulation of the generator winding by means of a megohmmeter for 500 V. If the resistance is less than 0,5 megohms it is necessary to dry off the generator during 5 - 7 hours loading it with a current of intensity 60 - 80 A at a voltage not exceeding 60 V. For this purpose switch on the charging unit.
2) Check the fastening of all parts of the generator set. Check the quality of the contacts on the generator and engine.
3) Inspect the working surface of the commutator of the generator.
4) Check the brushes of the generator.

5) Inspect the flexible coupling between the engine and the generator, check the tension of the fan driving belt.
6) Fill the radiator with clean water up to the relief pipe neck and close the radiator filling neck with the cap.
7) Check petrol amount in the truck fuel tanks and refill them if necessary.
8) Refill the engine with oil.
9) Lubricate the bush of the engine water pump with solidol
10) Check lubricant content in the bearings of the generator
11) Add to the distributor shaft 1 -2 oil drops
12) Slide on the exhaust pipe a vertical stack and fasten it

Starting of generator set.

1) Fill the float chamber of the carburetter with petrol, pumping the lever of the petrol pump.
2) Close the throttle of the caburetter by turning the hand-wheel of the throttle control on the central switchboard 4-5 times in anticlockwise direction with drawing simultaneously the gas button.
3) Close to 2/3 the choke- valve
4(Switch on ignition
5) Depress starter button and start engine
6) The engine having been started release the choke valve button.
7) Set middle speed of engine (800-900 revolutions/min), by means of the fixing handwheel on the gas button and heat up motor letting it work for 5 - 10 min to a water temperature of 50-60°C.
8) Open left hole on the niche and loosen the right one so as to form a clearance of 40-50 mm. Open shutters below the motor crancase. Close cover of the niche floor. Give full speed to the engine releasing gas button and closing handwheel and then slow down the speed until an idle run with 1550-1600 RPM is obtained.
9) Adjust voltage to 125 V by means of the generator exciter rheostat. Switch on main switch on the central switch board and switch on charging units, distillator and boilers.

Generator set operation.

While the set is operating it is necessary to watch the aerothermometer and the electrical instruments on the central switch board. Watch water= level in the radiator and refill with water up to the relief neck if necessary-. Take care petrol not to leak from the carburetter or petrol piping joints.

At normal operation of the set with full load the engine should run at 1450-1500 revolutions/min.

Water temperature in the engine cooling system should not exceed 90-95° C. If water temperature is higher then 95°C and the right hole is opened to 40-50 mm, it is necessary to switch off some of the leads (up to 50%) and let the set operate in these conditions for some time. If water temperature falls down to normal the load may be successively increased. If water temperature remains again above normal stop engine, trace and repair fault.

The cover of the niche floor should be closed while the set is operating. Correct cooling of the motor may be achieved only if the niche floor cover is closed. Keep readings of the generator voltmeter and ampermeter in the limits of 125 V and 85-87 A.

Control generator voltage by means of the exciter rheostat. If the current exceeds the tolerated limits lower the load switching off any groups of charging unit or switching off the distillator or boilers.

Watch temperature of the generator and bearings. Normal temperature of the generator-body should not exceed 70°. If the temperature is higher than the tolerated limit, open the right wing of the niche fully, let the generator cool down and close it again.

Charging current for the storage batteries of the set should be in the limits of 8-18 A depending on the condition of the batteries and on the number of switched on units (ventilators, boilers or lighting).

Stopping of the engine.

To stop the motor it is necessary:

1) Reduce succe ssively the load switching off groups of charging unit, distillator or boilers.
2) Switch off main switch on the central s. itch-board.

3) Reduce generator tension by means of shunt-regulator
4) Reduce engine RPM to minimum turning the handwheel fixing the gas button.
5) Let the motor run at low RPM for 1-2 min.
6) Switch off ignition.

Running in the new engine.

New engine should be run in for twenty hours at idle speed or partly loaded (up to 25%). Should the engine have been run in for less than 20 hours before leaving the factory as could be ascertained according to the record in the engine book and the baffle in the carburetter inlet have not been taken away, the engine should be run in at idle speed (800-1000RPM) unloaded.

While running in the engine the generator should not be loaded by more than 25% of full load i.e. no more than 21 A. After 20 hours of run the baffle should be withdrawn.

For withdrawing the baffle it is necessary to break the seals on the carburetter, unscrew the fixing bolts and withdraw the baffle from its place between the carburetter flange and the inlet tube.

At full load (85-88 A at a voltage of 125V) the speed of the engine should, be in the limits of 1450-1500 RPM.

After the engine having be run in drain oil from the crankcase and refill fresh oil.

Maintenance of engine.

Maintenance of the cooling system.

Soft water (best of all-rainwater) should be used as cooling liquid. Using of hard water causes scale forming rapidly in the radiator tubes and in the cylinder block jacket thus the engine begins to overheat. When well water is used it should be softened by normal sodium orthophosphate (Na_3PO_4) 2 grams in a litre of water).

The water must not be changed often and should be only added.

To remove the scale the cooling system should be flushed with a mixture of 750 grams of caustic soda and 150 grams kerosene in a pail of water. The mixture should be poured in the cooling

system over night after draining the water off the cooling system. In the morning start the engine and let it run for about 10-15 minutes, then drain the mixture, flush the whole system with clean water and refill the cooling system.

For draining the water from the cooling system it is necessary to open the cock in the lower header of the radiator and the cock at the cylinder block water jacket pipe, as well as the radiator cap.

While the engine is operating water in the radiator should be added (if necessary) gradually so that the cold water could be continuously warned up. The radiator cap should be opened cautiously. Otherwise the hot water could be ejected by steam pressure.

Fan belt tension can be adjusted by offsetting the G-20 type generator after loosening the bolt fixing the belt tension and the bolt fixing the generator bracket.

For checking the belt tension push the belt by hand in the middle between the pulleys of the water pump and the generator. Flexure should "give" about 12-18 millimeters.

Measure the flexure with a ruler or stencil (Fig.58).

Check tightness of the stud-nuts of the cylinder block head. Tightening of the nuts should be done on the hot engine smoothly without jerks. The sequence of tinghtening the nuts is shown on the Fig. 71.

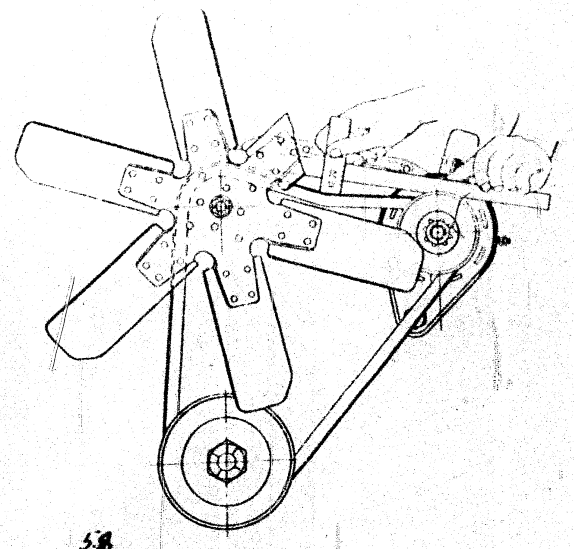

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Fig. 58: - Measuring strain in the ventilator belt.

Maintenance of lubrication system.

For lubricating the friction parts of the engine autoil 10 should be used. Oil should be poured into the crankcase through the clean funnel with strainer up to the upper "P" mark on the oil depth gage.

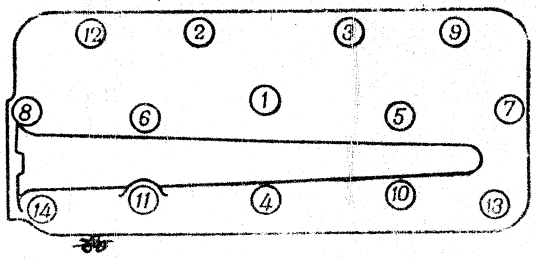

Fig. 59: - Sequence of tightening nuts on the cylindre block head.

Check the oil level in the crankcase before starting the engine. Is the oil level over the upper mark or under the lower mark on the oil depth gage the engine should not be started. In the first case the piston rings would be possibly burnt. The second case produces scoring of the friction parts and burning of the babbit bearings.

In a new engine oil should be changed first after 25 hours then in intervals of 50 hours of engine operation.

When the oil is drained off crankcase the lubrication system of the engine should be flushed by thin oil (for instance spindle oil). For this purpose 3 litres of oil should be poured into the crankcase flushing, the spark plugs should be unscrewed and the crankcase rotated by the starting crank for one minute. Then drain the flushing oil and refill 4,7 litres of fresh oil.

In case the strainers of the filter elements are heavy contaminated with sludge they should be carefully cleaned and washed. When washed dip them in oil withdraw them and let surplus oil trickle down. Assembly the filter elements and put them back to their place.

Change oil in the air filter after careful flushing. Pour in fresh oil up to the oil mark.

Maintenance of the fuel system.

Take off periodically the cap of the fuel pump, bowl clean and wash the filter strainer.

Check up the tightness of the petrol pipe joints and tighten nuts of the joints.

Control the fuel level in the floatchamber and clean it from deposits. In case jets are clogged, blow them through using compressed air from a truck compressor.

The fuel level in the floatchamber should be 15-16 mm as below the dividing plane. For adjusting the level bend the lever of the needle valve.

Adjust periodically the revolutions of the engine at idle speed, regulating engine operation at low but constant revolutions by turning the stop screw on the throttle lever. For this reason idle adjusting screw until the engine runs smoothly.

The engine RPM may thereby rise, in such a case continue turning the stop screw on the throttle lever until the RPM fall down to a constant minimum.

On engines with carburetter of the type K-22 it is necessary to adjust periodically fuel delivery to the main jets.

Doing this, it is necessary to screw in fully the needle of the main jet, then back it by 1 - 3/4 turn; meanwhile backing the needle further of 1/8 of a turn ascertain the most economical engine operation.

Excessive unscrewing of the needle causes overriching of the fuel mixture, excessive consumption of fuel and overheating of the engine. Unsufficient unscrewing of the needle reduces accelerating capacity of the engine accompanied with excessive fuel consumption.

Choke and throttle valves control is adjusted by means of extending or shortening the armoured cables so that when turning the handwheel of the gas button control by 9-11 turns the engine in running at minimal constant R.P.M.

When the air button is pulled out the choke valve should be closed fully and when the button is fully depressed in.-the choke valve should be fully open.

Maintenance of speed governor.

It is necessary to tighten periodically the securing bolts of the speed governor housing and to avoid oil leakages from untight joints. Is the packing in the governor worn out and oil leaks it should be replaced in due time.

When positionning the governor, the backlash of the camshaft and intermediate gear mesh should be 907-0,15 mm

Adjust engine RPM by means of the head of the governor spring tensionning mechanism.

To increase or decrease RPM, turn the head clockwise and anti-clockwise respectively.

Maintenance of ignition system and electrical equipment.

Lubricate the bearing of the distributor shaft after every 150 hours of engine operation and screw in the lubricator cap by one turn for this purpose. The lubricator should be filled with solidol. At the same time 2 - 3 drops of oil should be added to the felt packing in the recess below the rotor and one drop on the breaker arm shaft.

When lubricating the packing asvid oiling of breaker contacts. Inspect the state of the contact surface of the breaker. In case of oxydation or burning clean them with needle-fils. The gap between the open contacts of the breaker should be about 0,45 - 0, 55 mm. To adjust the gap loosen the clamping screw and turn the adjusting cam.

After adjustment tighten the screw fully again.

Set ignition timing when necessary in this sequence:

1) Withdraw the screw from the cover of the timing gear and insert it reversely in the hole. Turn the crankshaft until the screw end enters in the camshaft gear hub.
2) Turn the distributor shaft so that the beaker contacts starts opening and the rotor arm point is in line with the point of the first cylinder.
3) Loosen the distributor clamp screw.
4) Put the distributor in place and fix it to the cylindre head.
5) Loosen the clamp bolt and turn the distributor clockwise so as the distance between the marks being 7 mm.
6) Fix the distributor screw.
7) Adjust the screw in the cover.

When engine loudly knocking the advance angle should be reduced, turning the distributor anticlockwise by one grade on the hand advance scale. When engine not knocking the distributor should be turned by one grade clockwise. Each grade on the hand advance scale corresponds to 2° or the ignition advance angle.

Use spark plugs of the M-15/15 type with 18 mm thread and a 15 mm long insulator shell for the engine. Use of M-12/15 type spark plugs is allowed.

Gap between spark plug electrodes should be about 0,6-0,7mm. If the gap is incorrect, adjust the side-electrode only.

For lubrication of G-20 type generator and MAF-4006 type starter motor bearings use fluid oil. Add in the front bearing of the generator 2-3 drops of oil and in the back bearing 5-6 drops. It is not allowed to add more oil as it could flow to the commutator and cause oiling thus the generator or the starter motor may misfunction.

<u>adjusting relay regulators.</u> When the charging current is lower than 8 A or exceeds 18 A and the regulator is not working steadily (the ampermeter pointer is oscillating all the time), adjust voltage of the current tightening or loosening the armature spring.

Clean periodically generator and starter motor commutators, clean them by "00" emeryeloth if necessary and wipe with a clean rug soaked with petrol. Carbon dust formed by wearing out of the brushes should be blown off by means of fruck compressor.

The storage battery should be kept clean, dust and traces of electrolyte should be removed and vent holes in the plugs cleaned. Remove dectrolyte from the surface by a rag soacket with a 10% mixture of caustic soda or liquid ammonia.

Refill distilled water so that the electrolyte level in the container being 3-6 mm over the protective ebonite shields. Watch the electrolyte temperature. Should it exceed 45° C it is necessary to open right hand door wing of the niche. If the battery does not cool off and violent "boiling" of the electrolyte appears it is necessary to reduce the charging current to one half adjusting the relay regulator.

Watch carefully the terminals to be firmly connected with 12V and 8 V contacts on the storage battery, clean them systematically

from oxyde and lubricate them with vaseline or solidol. Watch particularly the additional 8 V contact which should not be loosen in cell connector. If the contact is loosen tighten it immediately.

Maintenance of generator.

The generator should be systematically checked. Attention should be paid especially to the brushes and commutators.

When generator is operating the brushes must not spark on the periphery. Some sparking is allowed when generator is fully loaded.

The commutator should be periodically cleaned with a clean rag soacket with petrol.

The brush dust should be blown off with air by means of a bellows. Worn out brushes (with a height up to 12 mm) should be replaced by new brushes of the type EG-4.

New brushes should be shaped preliminarily with "00" emery cloth. Shaping is to be carried out on a circular wooden pattern having the same diameter as the commutator.

After having changed the brushes load the generator (in the period of running in) for 12-12 hours with no more than 50% of nominal output.

Scale on the commutator should be cleaned with "00" emery cloth the brushes being lifted or pulled out. If the commutator is worn uniformly the mica insulation between the commutator plates should be removed as much as is necessary up to a depht of 1,5 mm. Is the commutator wear not uniform, the commutator should be turned off in the mechanical workshop.

The clearance between the commutator and lower edge of the brush holder should be in range of 2-4 mm.

Check systematically the bearing warm-up. Temperature should not exceed 70°C.

Lubricate bearings with constaline GOST 1957-43 and do not fill more than 2/3 of the cavity between lid and bearing.

Maintenance of elastic coupling.

The elastic coupling between engine and generator works reliably for a long time when the engine and generator are correctly alig-

ned in the frame of the generator and the bolts fixing the generator set to the floor of the body are tightened.

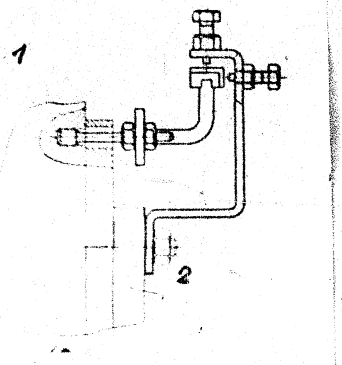

Fig. 60: - Device for aligning the engine and generator shafts.
Terms in the figure:
1 - flywheel
2 - coupling

Aligning of the generator and engine is checked by a special device (fig. 60, 61).

Instructions for aligning the shafts are given in appendix 2.

If aligning is incorrect, the elastic coupling is getting hot during engine operation and might be distorned. It is necessary to check periodically and adjust fixing of the generator set to the frame and fixing of the frame to the floor to of the body while the generator is running and to watch carefully the coupling and its fixing.

Fixing bolts of the frame should be tightened uniformly-tightening successively the first bolt on the left side and the last bolt on the right side, then the last bolt on the left side and the first bolt on the right side etc.

Temperature of the texgumoid coupling should not exceed that of the fly-wheel. If cracks or breakes appears on the texgumoid material it should be replaced.

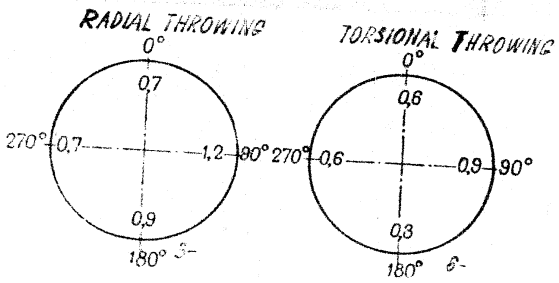

Fig. 61: - Scheme of the remarks while aligning the engine and generator shafts.

1 - Running untrue in radialdirection (radial throwing)
2 - throuwing 1,2- 0,7 = 0,5
3 - " 0,9- 0,7 = 0,2
4 - Torsional Running untrue (Torsional throwing)
5 - throwing 0,9 - 0,6 = 0,3
6 - Measure of untrue running throwing 0,6-0,3=0,3

VI. Use and servicing of charging units.

Prepairing the charging units for operation.

Take out the boxes of the charging units and place them in the tent or on some other place where charging, of the storage batteries will take place; open legs hinged on the bottom of the box and put the box on the ground.

Open the locks of boxes and the upperhalfs of the charging units and secure them. Inspect the contact joints on the panels and rheostats! Put the sliders on the rheostats in such position where all resistances are fully engaged, make sure that the sliders glide on the rheostats smoothly and that they touch tightly the wires of the winding. Put all switches to the "Off" position. Check the "Zero" position of all pointers of controll instruments and adjust it with adjusting screw, if necessary.

Put the batteries to be charged in groups, arrange them on wood planks and interconnect the batteries with wire leads having spe-

cial termenals. Connect the long wire leads to the terminals of the marginal batteries and to the charging unit, take care of polarity (ie. join the "+" contact of the battery to the "-" contact of the charging unit).

Open the below truck body, take out the charging cables and insert them into the sockets of the intermediate as well as into the sockets at the right side of the upper half of the box after having put aside the protective planks.

Guiding plugs and holes in the sockets and plugs all secure proper connecting and polarity. Notwithstanding before connecting group to the charging unit, it is necessary to make sure that the charging cable and the wires to the storage batteries are connected properly. Doing this, switch on the main switch on the charging unit panel and check correctness of connections according to the position of the voltmeter pointer. If the connection is correct the pointer deviates to the right and shows the voltage in the charging unit.

Operation of the charging unit.

To charge the storage batteries it is necessary to proceed as follows:

Switch on the main switch on the charging unit panel. Switch the switch of the first group into "On" position and turn back the handle of the rheostat-slider of this group until the necessary charging current is obtained (according to Ammeter reading). Proceed similarly with the other groups where batteries are connected for charging.

While charging watch cerafully the measuring instruments of the charging unit and in case that intensity of charging current (alters adjust it by means of the rheostat).

Take care reading the measuring instruments, the total load of the PN-100 type generator not to exceed 85 A at 125 V. If the load exceeds this limit reduce charging current in the groups or switch off some of the groups.

Keep voltage of the PN-100 type generator at 125 V by means of the shunt rheostat.

It should be born in mind that the volatge of the PN-100 type generator with shunt-excitation quickly changes with the load.

For instance at constant speed of the engine, switching off 20% of the load results in a voltage increase of 18 V and switching off 100% of the load causes an increase of 50 V and switching off the charging unit No.2 - 30 V increase.

For this reason, when one of the charging units is switched off without reducing the generator voltage to normal (125V) the intensity of charging current in the switched on charging unit rises rapidly thus the protective devices may burn out and the rheostat windings get red.

Watch temperature of wires and of plug and bolt contacts and in case of exessive heat or burning of terminals, switch off immediately the main switch on the central switch-board; stop the engine of the generator set and trace out the fault. Do not start again before having repaired the fault.

It is necessary to keep in mind that storage batteries have to be charged by initial current for 6-7 hours and by final current for 13-14 hours.

When discharging storage batteries it is necessary to switch the switch of the charging unit into the position of discharge.

Turn the handle of the rheostat slider until necessary discharging current is obtained. During discharging and especially when comming to end watch the ammater of the discharging group and if the discharging current changes regulate it by means of the rheostat.

Check systematically the voltage of each cell of the storage battery; stop discharging.

When voltage of 1,7 V for on e cell is reached stop discharging putting the switch in the "Off" position. It is necessary to take into account that when all groups are switched on for discharging, the charging units will operate in the most adverse temperature conditions. For this reason switching for discharging all groups of charging units simultaneously is not recommended.

Stopping operation of charging units.

Having finished charging or discharging of any group of storage batteries, the latter must be cut off by putting the corresponding switch in "Off" position.

9) Lift one side of the set frame, insert a wedge under it and take it out carefully by means of a crowbar so as not to rub against the edge of the hole in the niche.
10) The set may be taken out for a half or entirely if necessary.

To take out the set it is necessary to lift it to half, join the rope to the frame (there are holes for this purpose) and take out the set by means of a crane.

When taking out the set it is necessary to preserve the wedges put under the frame, to retain their number and the places where they were put in memory as to be able to put them back to the right place when the set is moved byck. To preserve the wedges it is advisablemto tie them to those parts of the frame where they belong.

To install the set the instructions have to be followed in reverse order together with the instructions about engine and generator alignment.

Instructions for a long time storage of the generator set and the charging and distributor set.

The generator set has to be protected for a longer period when it is stored or during railway or water transport and when work is interrupted for more than a month.

To protect the set for a prolonged period it is necessary to prepair the engine and protect the posts from corrosion by means of protective smearing.

Preparations for protection of the engine are done in the following order:

1) Start and warm up the engine. Flush the lubrication system with fresh oil.
2) Drain fuel, water and oil from tank, radiator and engine, turn crankshaft of the engine several times by means of the starter of starting handle so as to remove the remnants of water.
3) Take out spark plugs and spray 50-100 grams of oil into each cylindre, then turn slowly 2-3 times the engine crankshaft by hand. Put back spark plugs.
4) Loosen ventilator belts.
5) Put a light smear of protective grease warmed up to 50-60°C (technical vaseline or gun grease on all un-pained parts with a soft brush.

6) Charge storage batteries to full capacity, fill up level and density of the electrolyte to normal, put back the plugs, dry battery surface, clean cable terminals and cell connectors and smear them with vaseline.

The battery should be separed from the set.

Batteries stored for a prolonged period should pass through the control repair cycle.

To prepare generator for long-time storage it is necessary to:

1) Take out brushes from holders and wrap them up in greased paper, put them on the holders so that they should be held by the springs of the holders. Do not connect wires to brushes.
2) Wrap up commutator in greased paper.
3) Unpained parts should be protected from corrosion by technical vaseline or gun grease.

Grease spare parts and instruments with protective grease and put them in the box.

It is necessary to conserve thread screw of charging unit by a light smear with technical vaseline or gun grease.

Damaged paint on generator set or on the charging unit should be restored.

Instructions for puttingin use the generator set and charging unit.

Before starting the engine after a longer storing period it is necessary to, prepare the engine in this way:

1) Warm up the engine filling hot water (90-95°C) into the cooling system with opened drain cock. Continue warming up for 5 -6 hours to full dilution of grease. Warming up the engine with steam is strictly prohibited.
The mixture of lubricants serving to grease the engine gradually trickles down into the crankcase and through and flows out through the drain pipe.
When the engine thoroughly warmed up it is necessary to turn the crankshaft by hand 5-10 times so as to entirely remove protective grease.
2) Having removed protective grease it is necessary to flush crankcase with clean oil and to refill with fresh oil according to the chart.

3) Protective grease on the external parts of the engine should be removed with a soft brush or a rag wetted with petrol and wipe these parts with a clean rag.
4) Clean generator carefully from dust. Put brushes into the holders. Clean commutator with a clean rag wetted in petrol.
5) Check insulation of generator. The resistance of this isolation should not fall below 0,5 megaohms. If resistance is lower , it is necessary to dry generator until resistance reaches 0,5 megaohms or more. To check resistance use megaohmmeter for 500 V.
6) Remove protective grease from lead screws of cherging unit.

Contents.

AUTOMOBILE OXYGEN-FILLING STATION "AKZS-40"

Description and instructions for use.

I. DESIGNATION OF THE STATION AND GENERAL INFORMATION.

The Automobile Oxygen Filling Station "AKZS-40" is destined for filling cylinders on board of an aircraft with medical oxygen on aerodromes.

The pressure of oxygen in the cylinders, filled in this way may be increased up to 150 Atmospheres either from the own supply of the station or from outside transport cylinders. The own supply of the station is refilled by pumping over station oxygen from the transport cylinders into the [illegible] battery of cylinders. For filling of low-pressure cylinders the station is equipped with a pressure reduction gear, adjusted to 30 Atmospheres.

The station is mounted on a chassis "ZIS-150" and as far as its driving properties are concerned, it may be compared to a "ZIS-150" truck.

The equipment of the station consists of a battery of oxygen-filled cylinders (15 pieces), of a pressure multiplying compressor, of a control panel, of the oxygen circulation and of a dehydrating equipment.

The compressor is driven by the truck motor by two cardan drives through a power distributing gear box, a reducing gear and a elastic clutch, enclosed into the crankcase of the compressor.

The body of the station has a strong metal framework and is on the outside coated by steel sheets; the station body is divided by a partition into a cylinder compartment and a compressor compartment. The walls of the compressor compartment of the station's body are thermoinsulated and this compartment is provided with a heating battery, using the truck exhaust gases.

II. TECHNICAL CHARACTERISTICS OF THE STATION.

A. Principal data.

1. Output of the station (at a starting pressure of 80-100 Atmospheres and a final pressure ratio = 3 /40 m^3/h.
2. Working pressure during filling 150 Atmospheres.
3. Consumed power 5 HP.
4. Capacity of the battery of oxygen cylinders (converted to the pressure of 1 Atmosphere):
   a. full capacity . . . . . 90 m^3
   b. working capacity . . . . . 80 m^3
5. Humidity of delivered oxygen (in 1 m^3 of oxygen) not more than 0.07 Grammes.
6. Permitted uninterrupted working time 4 hours.
7. Warranted service life of the station 1000 hours.

B. Tactical specifications.

1. Dimensions:
   a. length . . . . . 6.700 m/m
   b. width . . . . . 2.350 m/m
   c. heigh . . . . . 2.765 m/m
2. Wheel-base . . . . . 4.000 m/m
3. Wheel track:
   a. Front wheels (measured on the ground) 1.700 m/m
   b. Rear wheels (measured between the centers of double tyre wheels . . . 1.740 m/m
4. Minimum clearance (at normal pressure in the tyres and maximum load):
   a. below the front axle . . . . . 325 m/m
   b. below the rear axle . . . . . 265 m/m
5. The minimum turning radius of the outer wheel:
   a. to the right . . . . . 7,5 meters
   b. to the left . . . . . 8,- meters
6. Weight of the station with full load in field service . . . . . 6.600 kg

7.	Weight of the filled chassis of the truck	3.560 kg
8.	Weight of the body and equipment of the station	3.040 kg
	Distribution of load:	
9.	Front axle	2.170 kg
10.	Rear axle	4.430 kg
11.	Speed of movement of the station on highways	25/30 km/h.

C. Oxygen cylinders battery.

1.	Number of oxygen cylinders in the battery of the station	15 pieces
2.	Grouping of the cylinders . .	5 groups of 3 pieces
3.	Holding capacity of one cylinder . . .	40 litres
4.	Working pressure in the cylinder . . .	150 atmosph.
5.	Type of the cylinder valve	"KVE - 46 M"

D. Compressor.

1.	Type of compressor	Vertical plunger piston, one stage compressor
2.	Number of cylinders	3
3.	Diameter of the plunger piston	22 m/m
4.	Stroke of the plunger piston .	90 m/m
5.	Number of revolutions per minute	160/200
6.	Direction of rotation	anticlockwise, when locking from the side of the pump
7.	Sealing of the plunger piston	by U-shaped leather gaskets
8.	Main bearings, bearing linings and bushings of connecting rods	Made of the plastic "Textolit"
9.	Lubrication:	
	a. of the main bearings lower ends of connecting rods	Flood lubrication by dynamite glycerine with an anticorrosive addition (2% potassium chromate and 0,13% of sodium hydroxide from the weight of glycerine).

	b. of the crossheads and upper ends of connecting rods:	Force feed lubrication by dynamite glycerine with an anticorrosive addition (2% potassium chromate and 0,13% of sodium hydroxide from the weight of glycerine).
	c. of the gaskets of the plunger piston:	Force feed lubrication by a mixture of water and glycerine (20% solution of glycerine in distilled water).
10.	Quantity of glycerine poured into the crankcase:	5.3 liters
11.	Capacity of the reservoir for the solution of glycerine in water:	1.25 liters
12.	Type of safety valve:	Spring valve, equilibrated, with a diaphragm sealing
13.	Pressure causing opening of safety valve (beginning of leakage):	165-175 atmospheres
14.	Cooling of oxygen:	Water bath on the cylinder-heads, bath on the coil pipe of the moisture separator, air cooler at the circulation.
15.	Capacity of the water reservoir of the compressor:	5.5 litres
16.	Highest permitted temperature of the glycerine in the crankcase:	65° Centigrade
17.	Warranted service life of the gaskets:	50 hours
18.	Weight of the empty (unfilled) compressor:	152 kg

E. Dehydrating equipment.

19.	Type of the moisture separator	Balloon-shaped, centrifugal, not provided with filling, working on the principle of loss of velocity.
20.	Type of dryer:	Sillica gel
21.	Absorbing ca	es

22. Time of efficient working of one charge of Sillica gel: 24 working hours

F. Control panel and oxygen circulation.

1. Instruments fitted on panel:
   a. Oxygen valves of the type "KVE-46M" with flange joints for fixing to the panel . . . . 19 pieces
   b. Electric speedometer for measuring the number of revolutions of the compressor . . . . . 1 piece
   c. Aerothermometer for measuring the temperature of glycerine in the crankcase . . . . . 1 piece
   d. Pressure reducing valve for lowering the pressure of oxygen from 150 atm. to 30 atm., type "KR - 15" . . . . . 1 piece
   e. Oxygen manometer Ø 60 x 250 atm. 7 pieces
   f. Oxygen manometer Ø 60 x 60 atm. 1 piece
   g. Lighting and sound-signalling control switch . . . . . 4 pieces
   h. Press button switches, signalling to the driver . . . . . 2 pieces
   i. Press button switches, switching off the motor . . . . . 1 piece

2. Material and sectional dimensions of the main pipes for the circulation of oxygen . . . . . Copper, Ø 9x5 m/m

3. Quantity of sockets on rear outside . . . . . 6 pieces, of which
   a. for filling . . . 3 pieces
   b. distributing at 150 atmospheres 2 pieces
   c. distributing at 30 atmospheres 1 piece

4. Attachment dimensions: Special thread Ø 21.8 m/m, 14 windings in one inch.

G. Drive of the compressor.

1. Type of the power distributing gear box . . . . . Two gears

2.	Gear ratio:	
	a. of the power distributing gear box (low power run) . . .	2
	b. of the drive reduction gear .	1,92
	c. from the engine to the compressor	4,15
3.	Number of revolutions of the truck motor during the working of the compressor . . . . . revolutions per minute	665-830
4.	Elements of the drive	Power distribution gear box, reducing gear, two cardan drives, two built up hinges, two one-piece hinges, an elastic clutch
5.	Maximum angle of displacement of the flexible drives	9° 40′
6.	Filling capacity of the crankcase of the reducing gear (up to the level of normal filling)	1,9 litres.

III. THE BODY OF THE STATION.

The body of the station is divided into two compartments - the cylinder compartment, where the battery of oxygen cylinders is placed and the compressor compartment for the compressor and the control panel with the dehydration equipment. In the compressor compartment there is room for the operating personnel.

From the outside the framework is coated by sheet-steel of one m/m thickness. The coating is fixed to the frame by lap riveting. The joints are covered by stripes of thin bands. The roof of the body, made of sheet-steel one m/m thick, is assembled by lap riveting to the coating of the sides with an interlaid paint tape to secure waterproofness.

On the right side of the body there is a door above the

spare wheel. When changing the spare wheel it is necessary to open the door. The door is being closed by two window bolts situated on the inner side, and is held in open position by a bracket.

On the left side, above the filling neck of the fuel tank, there is a round hatch. The lock of the hatch is being opened by a screwdriver.

The floor is slightly elevated above the rear wheels and there are fixed the chests with the tools and spares of the truck. Supplementary plywood chests with light equipment of the ZIP are fitted to the coiling.

On both sides of the body there are windows. The windows are provided with double glass plates. One half of the window is fixed, the second one may be opened to the inside of the body and is kept open by a clamp.

Under the right-hand window, in the body, there is a collapsible table for the operating personnel. The plate of the table is fixed to the wall by hinges and is based on a turning bracket.

On the partition wall of the compressor compartment of the body a first-aid box containing the most necessary medicaments is fixed. In the left back corner a carbon dioxide fire extinguisher in an easily opening yoke is suspended.

A. The heating of the body.

In winter time the compressor compartment of
is heated by exhaust gases of the engine, cond
a heating coil suspended on the left side of
wall.

To prevent eventual burns, caused by
battery, the battery is covered with
The wall below the battery is protec
of zinc-coated iron sheet and asbe

On Fig. 2 the heating scheme
are shown.

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On the partition wall of the compressor compartment of the body a first-aid box containing the most necessary medicaments is fixed. In the left back corner a carbon dioxide fire extinguisher in an easily opening yoke is suspended.

A. The heating of the body.

In winter time the compressor compartment of the body is heated by exhaust gases of the engine, conducted through a heating coil suspended on the left side of the partition wall.

To prevent eventual burns, caused by contact with the battery, the battery is covered with perforated covering. The wall below the battery is protected by a shield made of zinc-coated iron sheet and asbest.

On Fig. 2 the heating scheme and the exhaust of gases are shown.

The gases are picked and controlled for heating purposes before passing the muffler by means of a switch box. In this switchbox there are two pipe sockets for the outlet of gas - one leading to the muffler, the other to the battery. The flow on the gas is directed by a turning flap.

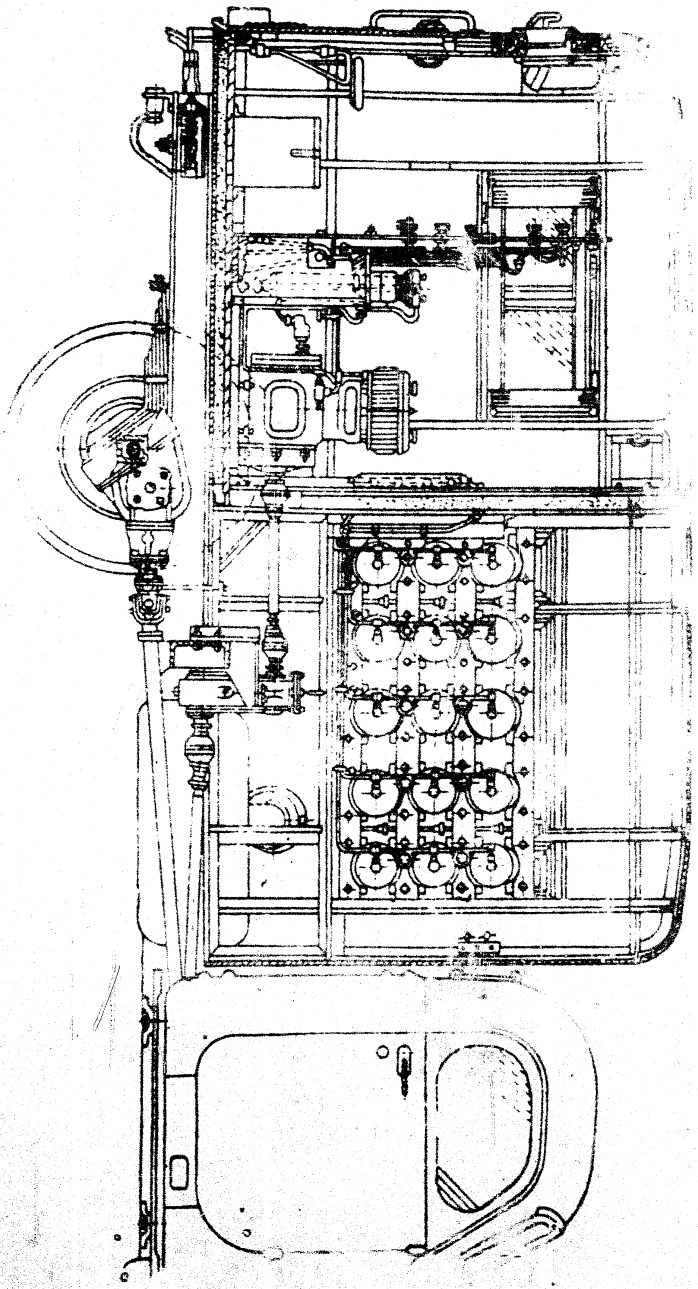


Fig. 1. General view of the station.

The flap is controlled directly from the compressor compartment by a handle, fixed on the partition wall next to the compressor. In order to switch on the heating, it is necessary to pull the handle up to the appearance of three guide pins out of the bushing and turn to the right. At

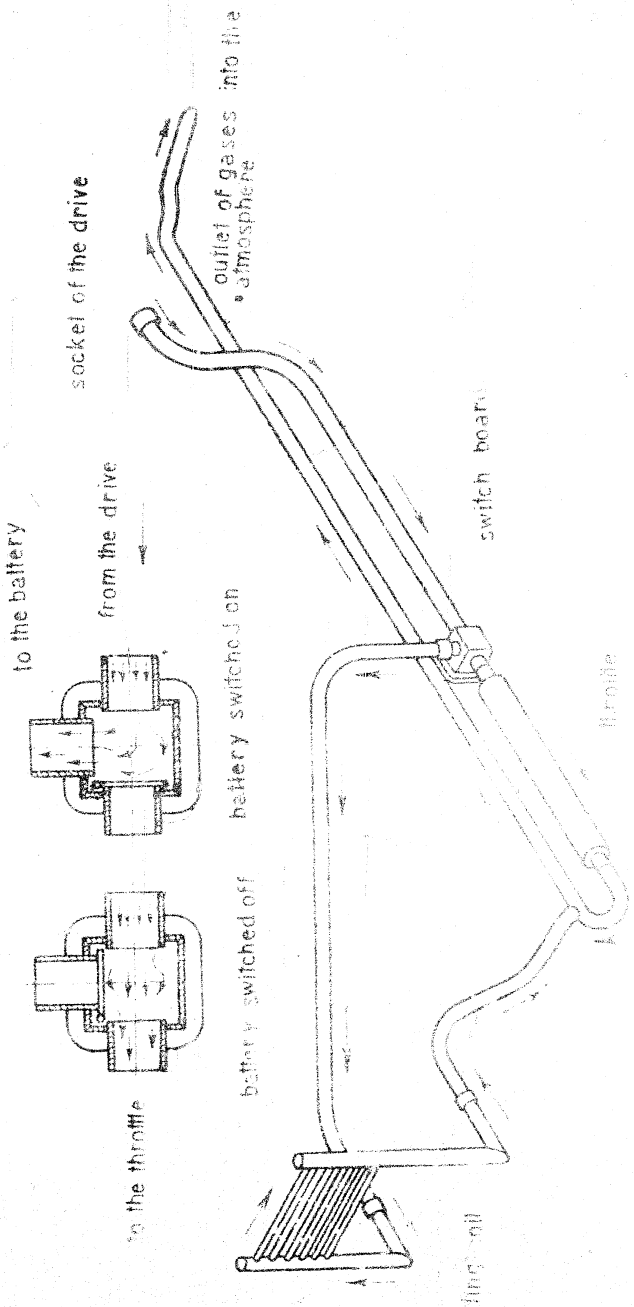


FIG. 2. HEATING SCHEME OF THE STATION.

this stage the flap covers the pipe of the muffler and the gases flow into the heating coil. The heating is being switched off by a reverse turn of the handle. While the heating is switched off, the flap covers the socket of the battery and is held in this position by a spring.

B. Electrical equipment of the station.

The station is equipped by one-wire electrical system with the positive pole connected to the body. As current source the storage battery ZST-98 or ZST-84 of the truck is used. The normal voltage is 12 Volts. The main wire diagram of the electrical equipment is shown on Fig. 3.

The electrical equipment of the station serves to provide lighting for the compressor and cylinder compartments, of the station body as well as for signalisation.

1. The lighting of the station body.

The lighting of the compressor compartment of the body is accomplished by three hemispheric roof lamps, one of which (L 3) is situated above the compressor and the other two (L 1 and L 2) above the control panel. The switching on and the switching off of the hemispheric lamps is performed by switches (V 1 and V 2) with small plates "Lighting of panel" and "Lighting of compressor". These small plates are fixed on the control panel.

On the front wall of the compressor compartment of the body a plug-socket (R) is fitted for plugging in a portable electrical lamp. In the cylinder part of the body, above the right hatch, a hemispheric roof lamp is fixed. The switching on a switching off of this roof lamp is done by the switch (V 4) which is provided with a small plate "Lighting of storage cylinders compartment". This small plate is fixed on the control panel.

For the illumination of the working place behind the station, a truck flood-light 50-00 is provided on the left side of the rear wall of the station body. This flood

light is fed by the main lighting system of the station, and the switch of the flood-light is placed on the truck driver's panel. The flood-light may be turned around its vertical axle up to 120 degrees and may be bent down up to 20 degrees around its horizontal axle. The floodlight is fastened in the required position by a nut and a ring nut spanner No 28-18.

2. Signalling.

The system of signalling is onesided; it serves for the transmission of signals beforehand agreed from the compressor compartment of the station body to the truck driver's cabin. For the transmission of signals three press button switches are fixed. When the press button with the small plate "Start compressor" is pressed down (K2) a little green signal-bulb on the driver's instrument panel is switched on. When the press button with the small plate "Stop compressor" is pressed down (K 1) a little red signal bulb on the driver's instrument panel is switched on. For a quick stopping of the compressor (in case of an accident, defects etc.) serves the press button (K 3) with the small plate "Stop engine". When this button is pressed down, the main coil of the inductor of the lighting system is connected with the body of the truck, the breaker is switched off and the engine stops. It is strictly forbidden to stop the engine by using the press button while the truck is moving.

A duplicating sound signalling is provided to attract the driver's attention to light signals and also for the case that the light signalling falls out of order. If anyone of the three buttons is pressed down on the control panel a sound signal is put into motion simultaneously with the transmitting of the light signal (sounding of the horn of the truck).

If there is no need of sound signalization, it may be cut off by a switch (V 3), fitted on the control panel and provided with a small plate "Switch off of sound signalization".

The lighting system of the compressor compartment of the station body and the system of signalling are connected to the lighting system of the truck and have a common safety fuse of 20 A of a thermovibrating type, placed on the driver's control panel on the side of the engine.

In order to prevent the possibility of electroelastic discharges in the oxygen circulating system, while the station is operating, the oxygen circulating system is provided with grounding connection. This is done by a pintle with a cable fastened on the rear side to the right longeron

Diagram of the truck lighting.

DIAGRAM OF THE THE LIGHTING

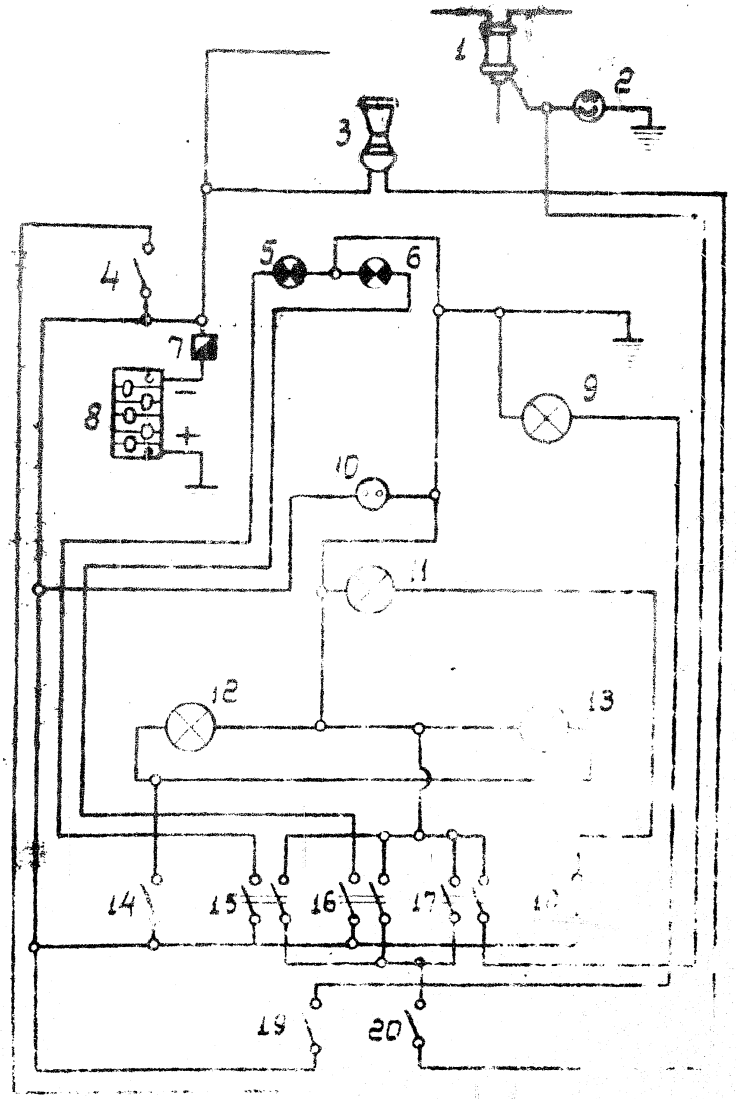


Fig. 3. Diagram of the
station. (See specification on page 13.)

of the truck. While the station is in operation, the pintle is dipped into the ground and during the motion of the truck it is fastened by clamps to the end of the right longeron.

1. Switch on coil
2. Interruptor
3. Sound signalisation
4. Switch off of the searchlight
5. The green signalling bulb "Start compressor"
6. The rod signalling bulb "Stop compressor"
7. Safety fuse
8. Storage battery
9. Hemispheric lamp of the cylinder compartment of the body
10. Plug socket
11. Hemispheric lamp of the compressor
12. Hemispheric lamp of the control panel
13. Hemispheric lamp for the panel
14. Switch off of the hemispheric lamps of the panel
15. Press button for signalling bulb "Start compressor"
16. Press button for signalling bulb "Stop compressor"
17. Press button "Stop motor"
18. Switch off of the hemispheric lamp of the compressor
19. Switch off of the hemispheric lamp of the cylinder compartment of the station body
20. Switch off of the sound signalling
21. Truck searchlight on the rear wall of the station body

IV. THE DRIVE OF THE COMPRESSOR.

The oxygen compressor of the station is brought into action by the truck engine (Fig. 4) through the power distributing gear box (1), the forward (2) and rear (3) cardan shafts and an intermediate reducing gear (4). The rear cardan shaft is linked up with the crankshaft of the compressor by an elastic clutch (5), placed within the body of the compressor.

The power distribution gear box is fastened by six bolts to the right hatch of the truck gear box. It has two gears: the first one for slow speed and the second one for high speed. When used with the station "AKZS-40", the first gear for slow speed is used. The driving end of the shaft of the power distributing gear box revolves clockwise, looking in the direction of the truck movement.

The arrangement of the power distributing gear box is shown diagramatically on Figure 6. In the cast-iron body, on an immovable axle (1), a gear train with a gear of $z = 23$ and $z = 13$ turns on a needle bearing. The main gear $z = 23$ is in constant mesh with the gear of the intermediary shaft of the transmission gear box. On the working splined shaft of the gear box (3), the second main gear (4) $z = 26$ and $z = 17$ slides in splines.

The sliding gear is moving in the splines with the help of a fork (5), fastened on the actuating shaft of the switch (6)- The diagram (Figure 6) shows the gears in their neutral position, when the output distribution gear box is not clutched in.

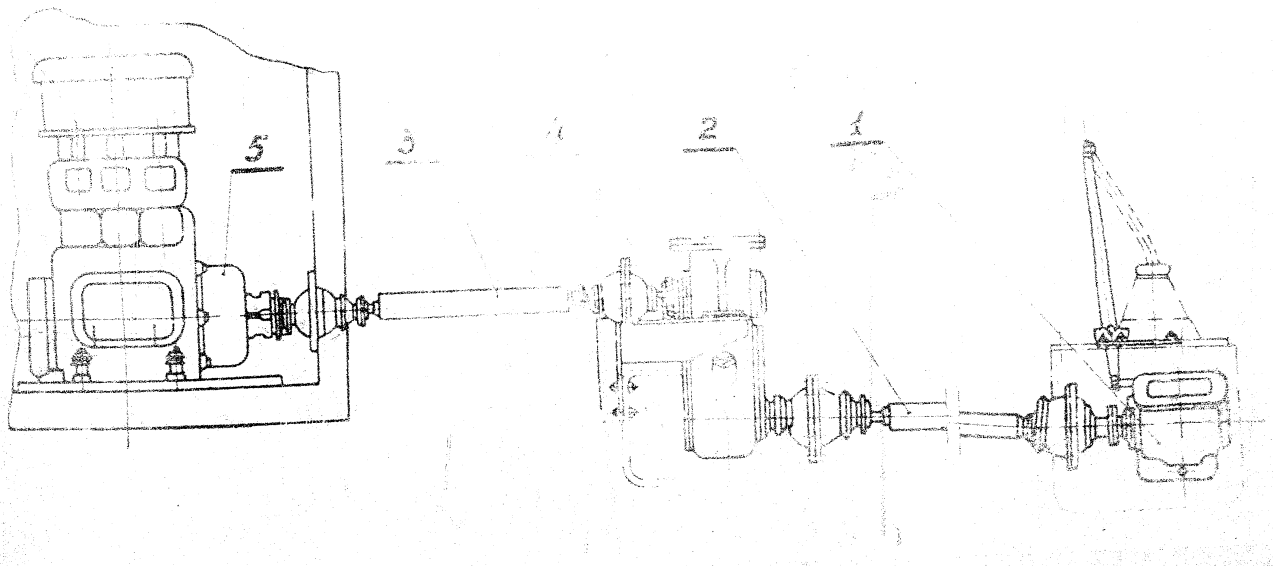


Fig. 4. Diagram of the dislocation of the main parts of the drive: 1 - gear box; 2 - forward cardan drive; 3 - rear cardan drive; 4 - reducing gear.

When moving the fork to the right, and consequently the handle of the lever "towards yourself", the pair of main gears of z = 13 and z = 26 is brought into mesh and the gear output distribution gear box starts working on "Slow speed". When the fork is shifted from its neutral position

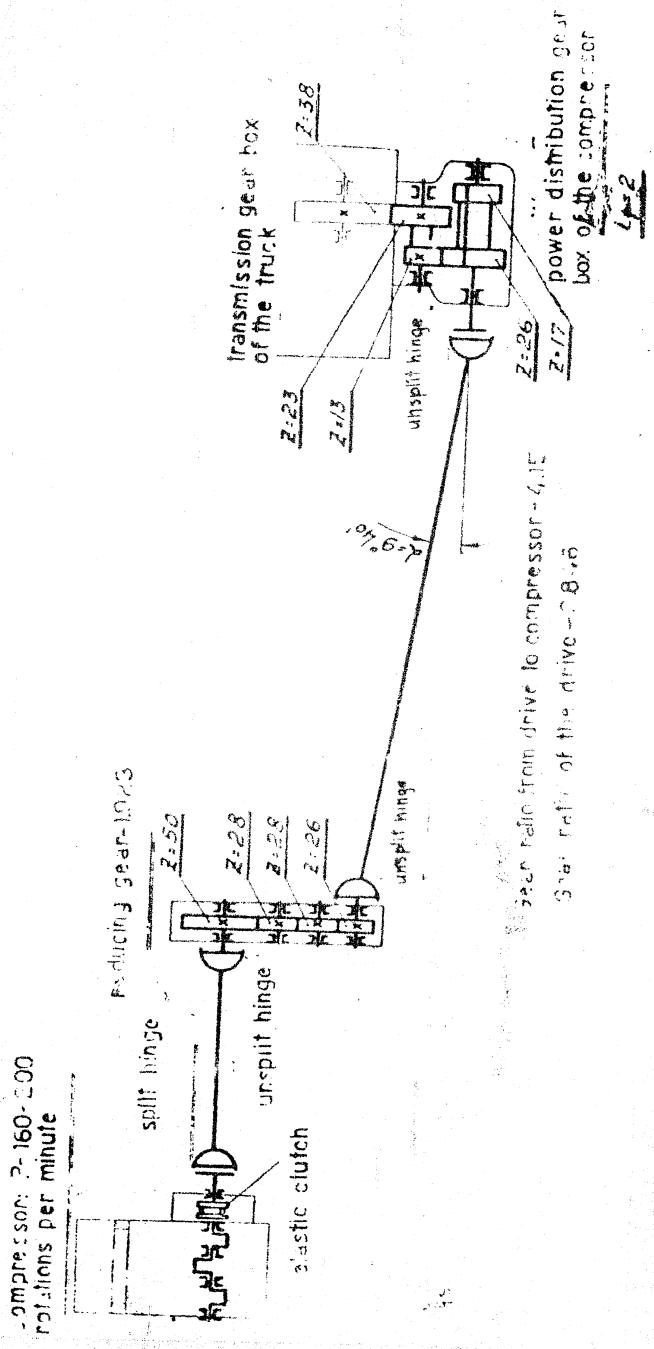
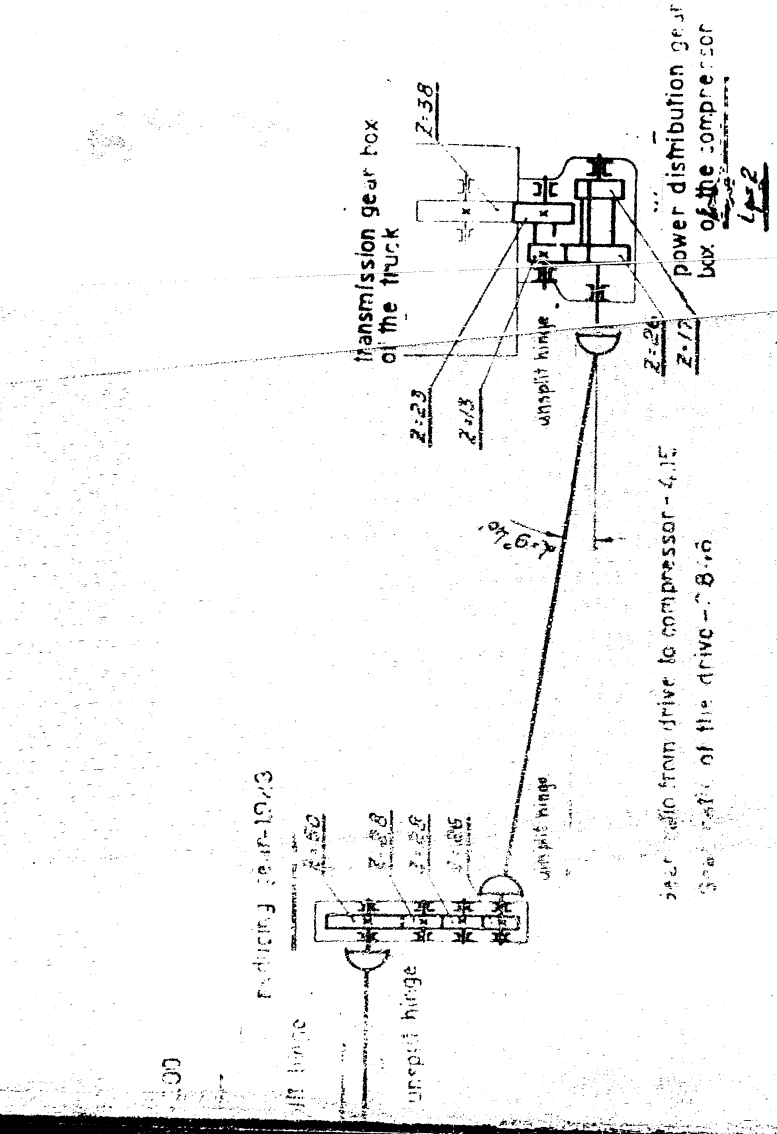


Fig. 5. Kinematic scheme of the drive.

When moving the fork to the right, and consequently the handle of the lever "towards yourself", the pair of main gears of z = 13 and z = 26 is brought into mesh and the gear output distribution gear box starts working on "Slow speed". When the fork is shifted from its neutral position



to the left, and consequently the handle of the lever "from yourself", the gears in z = 23 and z = 17 are engaged, it means, that the power distributing gear box will work on "high speed". In all of these positions the conducting fork is fixed by the ball of a spring lock (7).

Since for the station "AKZS-40" only the "slow speed" is used, a distance sleeve on the actuating shaft of the power distribution gear box is provided between the station body and the fork to avoid the clutching in of the "fast speed". In order to engage the drive of the compressor, it is necessary to pull "towards yourself" the handle of the lever of the power distribution gear box, and in order to switch off push the handle "from yourself" as far as possible.

The lever of the power distribution gear box is engaged, when the truck is stopped parking and the lever of the gear box in its neutral position. It is strictly forbidden to engage this lever while the truck is moving. The front and the rear cardan drives are made of a pipe Ø 42 x 5. To both ends of the pipes split projections are welded which are penetrating into the bushes of the cardan heads. The cardan drives have in their hinges a longitudinal freedom of motion, the longer shaft 10 - 15 m/m, the shorter one 5 - 8 m/m.

Two types of heads for cardan drives are used with the drive: the reducing gear is provided with unsplit hinges and the ends facing the distribution gear box and on the side of the compressor with split hinges. Thanks to this, it is possible to remove the cardan drives without removing the compressor, the reducing gear or the distribution gear box. In a similar way it is also possible to remove these elements without disassembling the whole drive. The rear cardan drive is placed in the direction of the crankshaft of the compressor without any angular displacement, and the front flexible shaft is declined by an angle of 9° - 10°. Apart from that, it is necessary when mounting the cardan heads, to take care that the forks of both cardan

heads of a particular shaft were placed in the same plane.

The cardan heads of the cardan drives are terminated by cups filled with solid lubricant.

The cardan heads and splined ends of the cardan drives are protected from dirt and dust by tarpaulin covers, propped up by conic springs, covering the ends of the rollers and the adjoining halves of the cups.

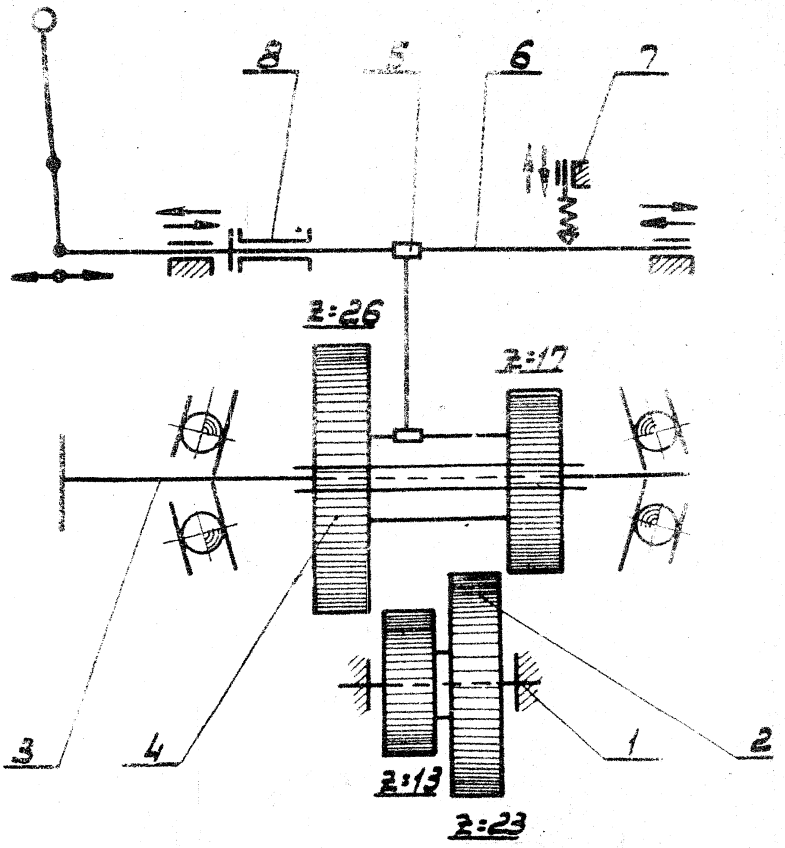


Fig. 6. Diagram of the gear box.

1. Immovable axle
2. Bearing shaft of the gear box
3. Splined shaft
4. Sliding shaft of the gear box
5. Fork
6. Clutch shaft
7. Stop
8. Distance bushing

The reducing gear of the drive (Fig. 7) is fixed on the wall bracket, held on the center beam of the chassis. It has an oblong cast-iron body. In this body four gears are placed in consecutive order, i.e. two working ones (2 and 3) with a gearing of 26 and 50, and two inserted (auxiliary) ones (4) with a gearing of 28 and 28. The general rear ratio of the reducing gear is 1,923.

The gears of the reducing gear are fastened with a wedge on shafts, i.e. the inserted gears on smooth ones, and the working gears splined ones (6). The shafts are leaning on ball-bearings (9). The protruding splined ends of the working shafts are provided with felt stuffing boxes (7), supported by packing nuts (8). All lids covering the bearing bushes are packed by paper washers. The body of the reducing gear is covered on the top by a flat lid (10). On the right, there is a plug on the inclined neck to pour the lubricant into the reducing gear (11). The plug is in the same level as the fastening of the inserted gears (4).

The lubricant has to reach the level of the inlet, as in the case of a lower level of the lubricant, the upper part of the gear would be lubricated in a poorer way. In the lower part of the body an outlet with a plug is provided (12).

The reducing gear is being filled by a mixture, consisting of 50% automobile lubricant "10" and 50% solid lubricant "L".

A kinematic diagram of the drive is shown on Figure 5.

V. COMPRESSOR.

A. General description (see Figs. 8, 9, 10.).

The purpose of the compressor is to pump oxygen into the cylinders, which have to be filled and to complete its working pressure (150 atmospheres). The compressor works continuously at a compression ratio not exceeding 3.

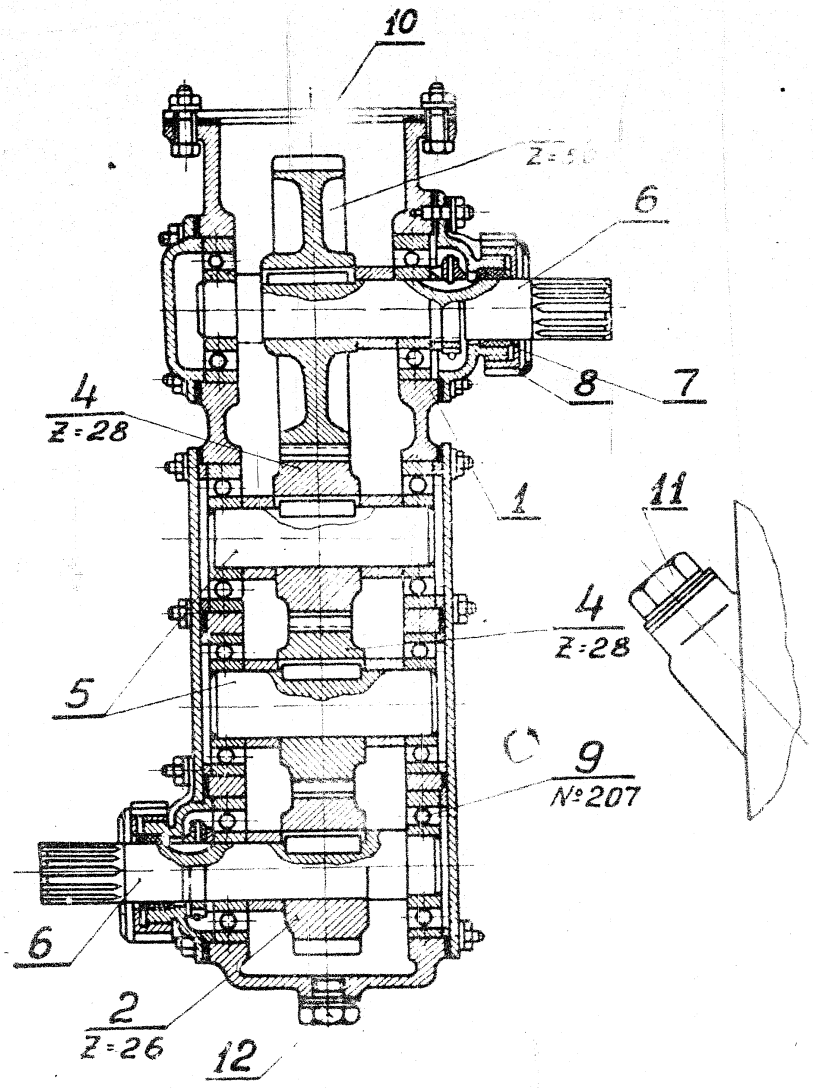


Fig. 7. Reducing gear.

1. Body
2. and 3. Working gears
4. Inserted (idle) gear
5. Smooth shaft
6. Splined shaft
7. Stuffing box
8. Packing nuts
9. Ball bearing
10. Lid
11. Plug
12. Outlet

So, if the oxygen is pumped from one cylinder into another of the same capacity, in order to attain the required pressure in the filled cylinder (for instance 150 atmospheres), the starting pressure in both cylinders has to be not less than 100 atmospheres. In this case the pressure in the

cylinder being filled will reach 150 atmospheres and in the emptied cylinder it will drop to 50 atmospheres. With another starting pressure in both cylinders for instance 80 atmospheres, the pressure in the cylinder being filled may reach only 120 atmospheres, whereas it drops in the cylinder being emptied to 40 atmospheres.

The type of the compressor is a plunger piston vertical,

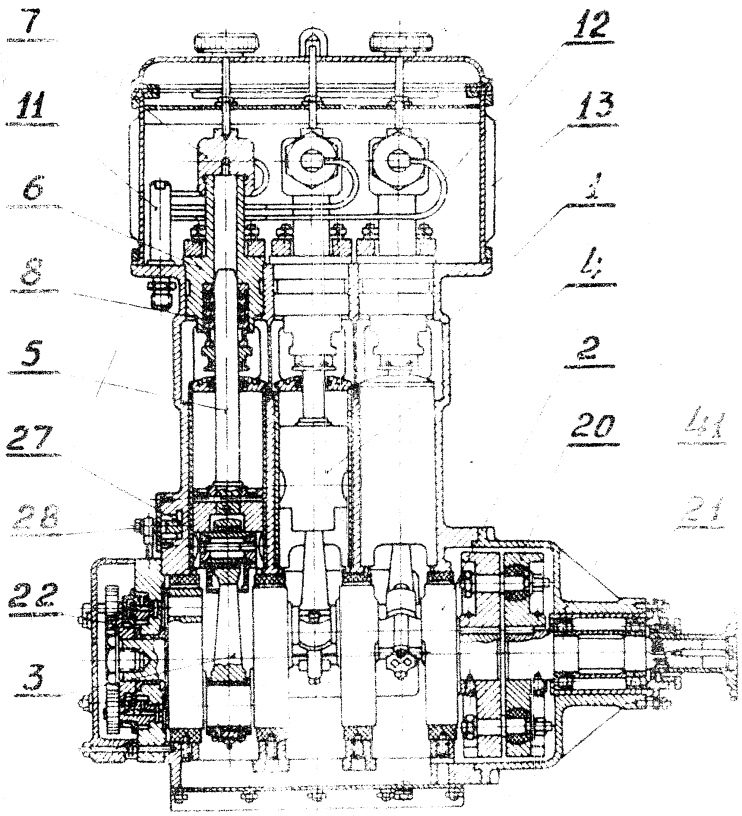


Fig. 8. Longitudinal section of the compressor.

1. Crankcase
2. Crankshaft
3. Connecting rod
4. Crosshead
5. Plunger piston
6. Cylinder
7. Cylinder head
8. Cups
11. Collector
12. Expelling pipes
13. Water cooler
20. Elastic clutch
21. Splined shaft
22. Pump driving gear
41. Cover of the clutch

one stage compressor with three cylinders.

The work of the compressor consists of the actions of sucking in, compressing and expelling of oxygen. During the downward movement of the plunger piston in the working cylinders, the pressure is decreasing and oxygen is sucked in from the storage cylinders through inlet valves, the collector with a filtrating screen and the circulation line. During the upward movement of the plunger pistons, the oxygen is being compressed in the working cylinders up to a pressure surpassing the pressure of the oxygen in the storage cylinders, which have to be filled, and is driven out of the working cylinders into the storage cylinders through high pressure valves, high pressure collector and the connecting line.

The sucking and high pressure valves are working automatically.

The oxygen, compressed in the compressor, is being cooled in the working cylinders, in the pipes of the high pressure line and by an air-cooler. The water destined for cooling the working cylinders and the collector, fills up a hollow space between the housing (13) and the upper cover of the crankshaft. The housing is fixed on the crankshaft with a rubber washer. The water is being poured into the container after the removal of the lid (23), and is let out through a small cock (24) in the flange of the crankshaft.

For the lubrication of the compressor glycerine and a solution of glycerine in water is applied. The main and connecting necks of the crankshaft, the crosshead and the upper ends of the connecting rods are lubricated with glycerine. The cups and the plunger pistons are lubricated with the solution of glycerine in water.

Dynamite glycerine or distilled glycerine of the first quality is used, with an anticorrosive addition, consisting of 2% potassium chromate (K 2 or 04) and 0,13% of sodium hydroxide (NaOH), the percentages being fixed according to the weight of the glycerine. Thanks to this addition, the glycerine acquires a greenish colour. The solution of

glycerine in water consists of one part of glycerine (with the anticorrosive addition mentioned above) and of four parts of distilled water measured by volume. The glycerine is poured into the crankshaft of the compressor through a gauge (26).

The glycerine level should be between the both checking grooves of the inspection window (25). The main and connecting necks of the crankshaft as well as the bearings of the splined shaft are flood lubricated by glycerine (they are put in a glycerine bath). The crossheads are lubricated by glycerine under pressure from the gear-oil pump (15) through the main pipe (18). The upper ends of the connecting rods are greased by glycerine pouring down through the axle channel of the crosshead. Apart of that, the glycerine is sprayed around, when the compressor is working, by the lower ends of the connecting rods, which provides a supplementary greasing for the crank and connecting rod assembly. The glycerine is being sucked out of the crankshaft by a scavenging pump through a filter (30). In case that the filter is clogged it may be cleaned up through the plug (29). When the compressor is working on slow speed, the filter may be blown through. To provide for the eventuality of an increased pressure in the main oil pipe, owing to the thickening of the glycerine by cold weather, the pump is fitted with a spherical safety valve (32). The glycerine flows down from the crankshaft to a tray on the side of the clutch.

The glycerine flows into the funnel of a trough, and therefrom it may be collected through a pipe into a special vessel. The outlet pipe, leading under the floor, is covered by a lid for protection against dust. The solution of glycerine in water is poured into a compartment of the crankshaft (27) through an inlet opening (37). The compartment consists of two channels on both sides of the cases; the channels are meeting at the front wall. The front wall is provided by a removable hatch (39) for the inspection of both sides of the compartment. The plunger piston and the cups are greased by force feed lubrication,

under pressure from the upper gear pump (14). The lubricant is sucked in through a filter (28), screwed into the hatch of the front-wall. The solution of glycerine in water is lead through the main pipe (16) under pressure to the injectors (17) and is flowing out in a small continual stream through the nozzles of the forked pipes on the plunger piston. The ends of the pipes are closed by screw-plugs, which may be removed for the cleaning of the nozzles. The cylinder walls and rings, through which the solution of glycerine in water flows out, are provided with suitable windows. The plunger piston takes up at its movement upwards some grease and lubricates in this way the leather cups.

The down-flowing solution of glycerine is gathered in a collector (36), from which it is led back through a

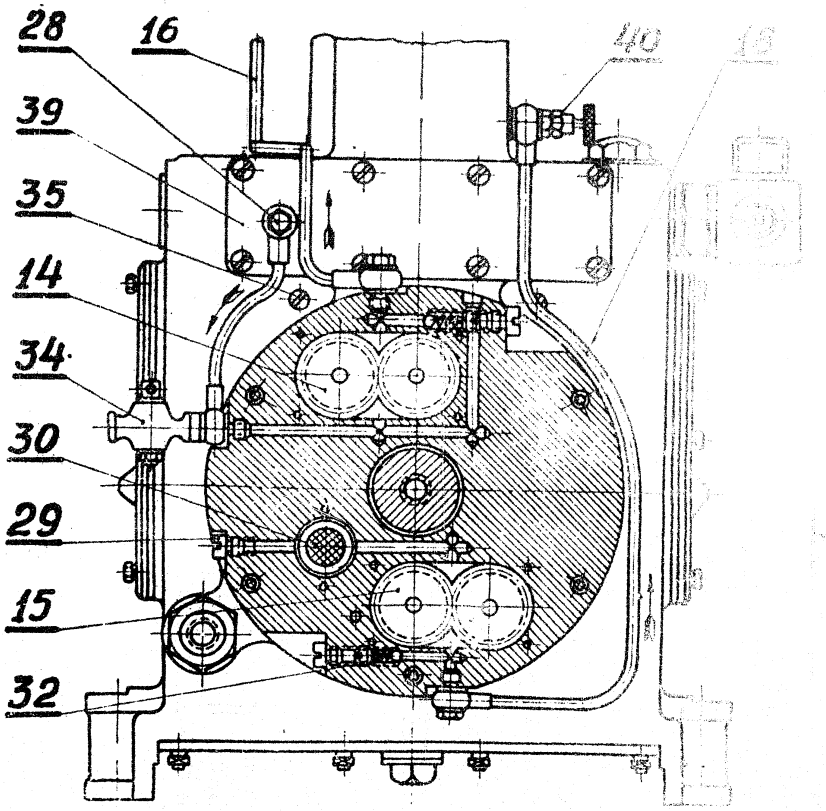


Fig. 9. Sectional view of the pumps.

channel (33) into the water-glycerine chamber above the central case. From this chamber, the solution of glycerine in water may be let out through a cock on the pump (34), and its remainders in the spaces of the front-wall through the outlet (35) below the hatch.

Explanation to Figure 9:

14. Pump for the glycerine-in-water solution
15. Glycerine pump
16. Main oil pipe for lubrication of the plunger pistons
18. Main oil pipe for lubrication of the crossheads
28. Filter of the glycerine pump
29. Plug of the glycerine pump
30. Glycerine filter
32. Safety valve
34. Cock for the outlet of the glycerine in water solution out of the pump
35. Plug
39. Hatch of the front wall of the crankcase
40. Pointer of the glycerine main oil pipe

On the right wall of the compressor, a safety valve (42) of a spring boarded type is installed with a diaphragm sealing connected with the main expelling and sucking pipelines. The valve is regulated for 165-170 atmospheres.

If the pressure is increased in the expulsing main communication, the safety valve opens and drives the remaining pressure into the sucking pipeline. The arrangement of the safety valve is shown on Figure 35.

B. Description of the main parts of the compressor.

1. Crankcase.

The crankcase of the compressor (Fig. 10, 11-1) is cast of grey iron casting. It consists of an rectangular frame

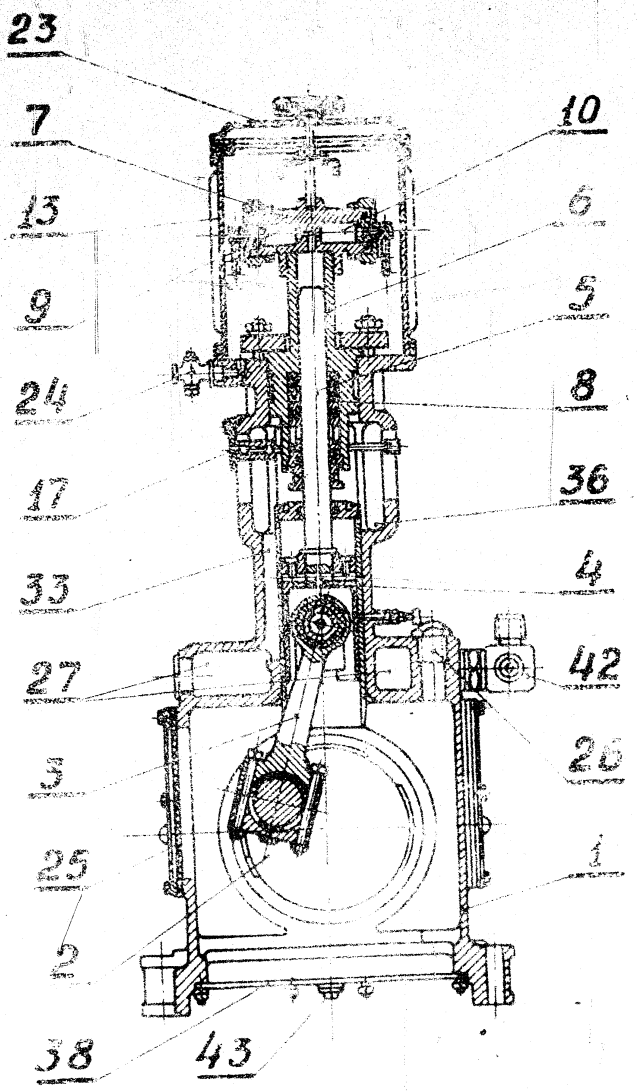


Fig. 10. Diametrical section of the compressor.

1. Crankcase
2. Crankshaft
3. Connecting rod
4. Crosshead
5. Plunger piston
6. Cylinder
7. Cylinder head
8. Cups
9. Sucking valve
10. Expelling valve
13. Water cooler
17. Injector
23. Lid of the water cooler
24. Cock of the outlet of water out of the cooler
25. Inspection window of the crankcase
26. Plug
27. Glycerine-in-water solution chamber
33. Channel
36. Collector
38. Bottom
42. Safety valve
43. Outlet plug

with two transversal partitions and a block of three cylinders with an upper flange. In the front-walls of the crankcase and in the partitions as well, there are bushes into which four main bearings made of the plastic Textolite are pressed (Fig. 11-3) with a tension of 0,23 - 0,35 m/m; the bearings are fixed in the bushes by stops.

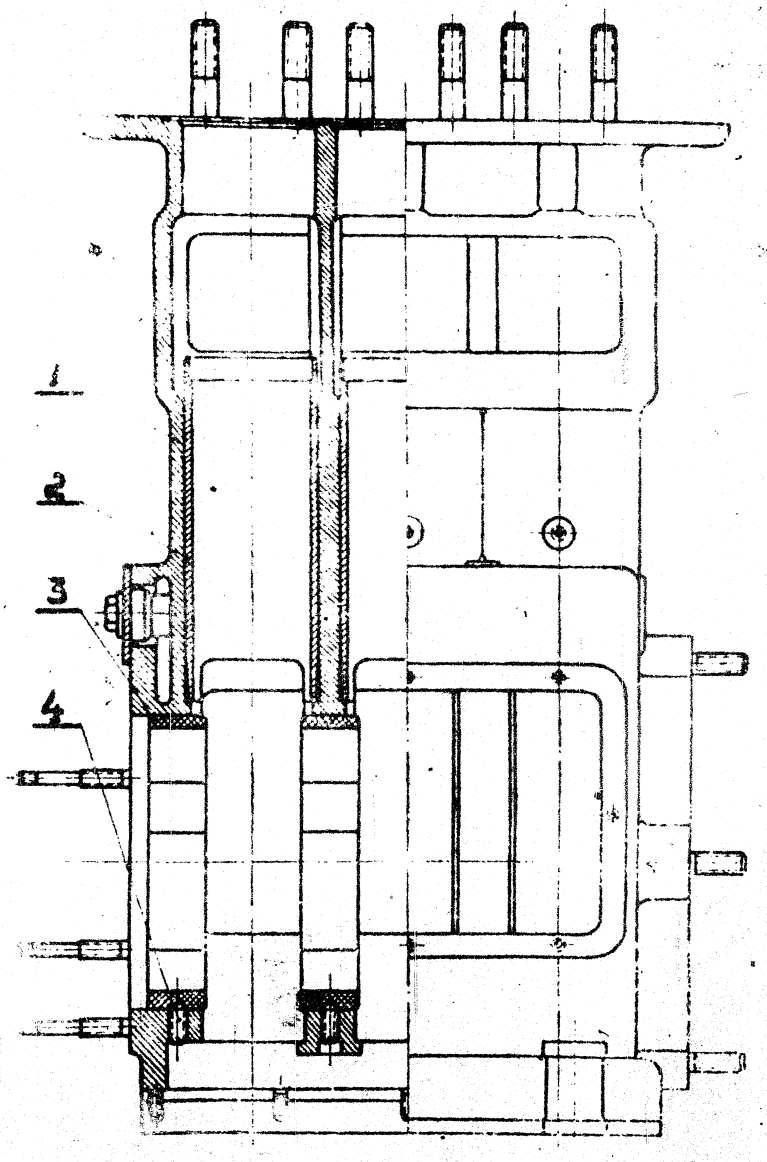


Fig. 11. The crankcase of the compressor.

1. Crankcase 2. Bushing 3. Main bearings 4. Stop

In order to increase the resistance of the bearings rings, working in glycerine bath, from shrinkage and swelling, owing to temperature changes, they go through a special heat-treatment.

The lower part of the crankcase is open and after full assembling it is covered by a flat bottom (38 Fig. 10) made of sheet-steel and put on a sealing. The side-walls of the crankcase are provided with windows, closed by transparent plexiglass plates (25) put into rectangular frames. In the upper part of the frame, between the cylinders and the side-walls, there are vessels for the glycerine in water solution (27), which are isolated from downside by cast walls. In the frontwall of the crankcase, opposite these vessels, there is a hatch covered by a steel lid (39, Fig. 9).

2. The crankshaft.

The crankshaft (Fig. 11 a) is provided with four main discform necks and three necks for connecting rods between them; the mutual angular displacement being 120°. On the ends of the shaft, there are two pivots: on the left side for the driving gear of the pumps, and on the right side one for the disc of the elastic clutch. If assembled, the left end of the shaft is put into the central opening of the pump as far as possible, and with the help of the gear and of two bronze stop rings, placed on both sides of the body, is fixed to the immovable body of the pump to prevent axial displacement. Axial clearance is established within 0,1 - 0,2 m/m and may be adjusted by the thickness of the stop rings.

3. Connecting rod.

The connecting rod (Fig. 12) has a round turned form. Its upper end is unsplit, the lower one split with two bolts. The bushing of the upper end (20) and the inserts of the lower end (4) are made of the plastic Textolite.

In order to assure abundant lubrication and sufficient cooling of the working insert, the lower end of the connecting rod is not covered, and especially the clamp of the connecting rod (6) is of a crosslike shape, and the lower not working lining (16) is made as a narrow strip.

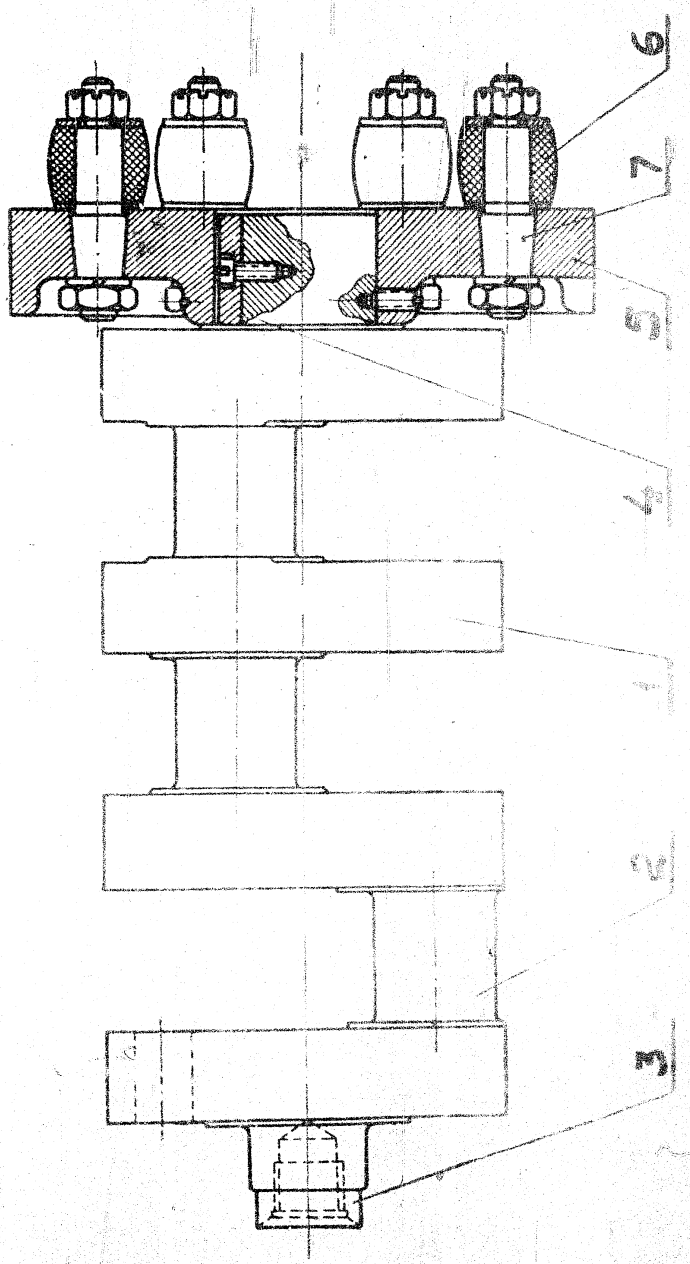


Fig. 11a. The crankshaft. 1-form-neck, 2-neck for connecting rods, 3- pump driving gear pivot, 4- clutch driven plate pivot, 5- driven clutch plate, 6- clutch rubber sleeve, 7- clutch finger.

The neck of the crankshaft is therefore uncovered at the lower lining and, for this reason it may be better lubricated and cooled.

The upper lining (4) is protected against outer interference by brass discs (15) put on brace bolts. The lower lining (16) is hermetically fixed to the clamp of the connecting rod by two brass bolts (17). The upper bushing is pressed into the end of the connecting rod without any complementary reinforcements. The busher is lubricated by glycerine, pouring down from the cup of the crosshead (22) through the annular channel of the end bushing (24).

4. The crosshead with the plunger piston.

The crosshead with the plunger piston (Fig. 12) are together an indivisible unit. The plunger piston (9) made of anticorrosive steel, is pressed into the cast-iron crosshead (8) and is fixed in its position by a rivetted peg (10). The purpose of the crosshead is to direct the movement of the plunger piston and to form a hinged connection of the connecting rod with the plunger piston. The crosshead is linked with the connecting rod by a hollow steel finger (11), inserted into the transversal opening of the crosshead through the upper end of the connecting rod. In the upper front-end of the crosshead a ring-shaped cup (22) is turned out, into which the glycerine is injected through the openings of the bushing. From this cup the glycerine flows through two axial (25) and one radial opening (26) to the walls of the crosshead and flows down through an axial central opening (14) into the grease funnel of the upper end of the connecting rod.

The upper end of the connecting rod is freely set on a pin with an axial clearance of about 2 m/m.

5. Cylinder.

The cylinder (Fig. 13) consists of a brass body (1) with 2 oval windows in the lower part, a steel flange (3) for

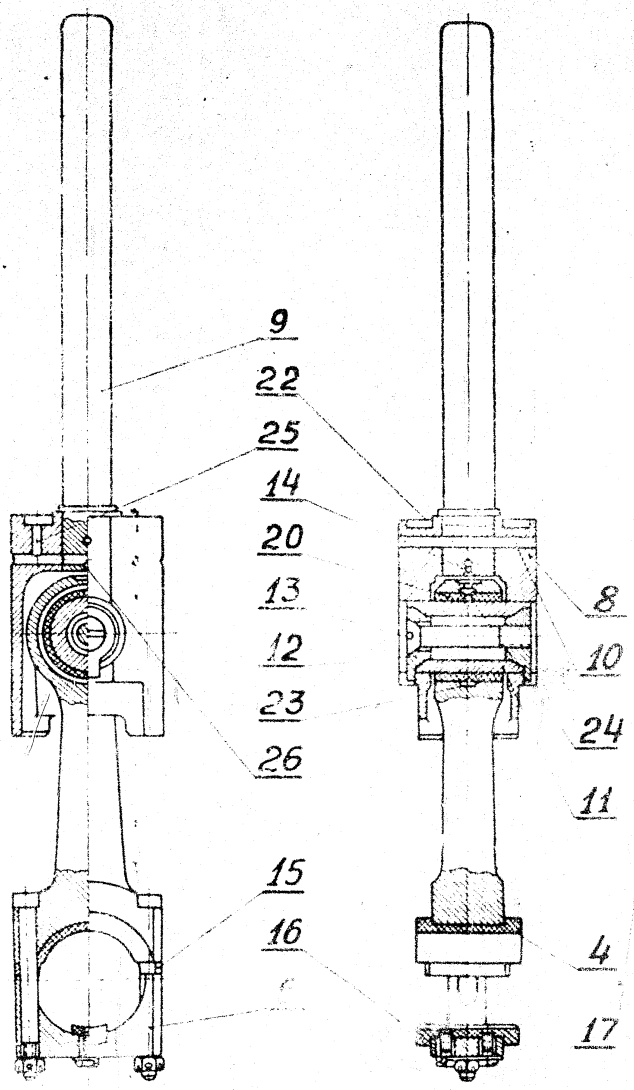


Fig. 12. Connecting rod and crosshead with the plunger piston.

4 - upper liner of the lower connecting rod end; 6 - clamp; 8 - crosshead; 9 - plunger piston; 10 - riveted spring; 11 - finger; 12 - disc; 13 - screw; 14 - central opening; 15 - disc; 16 - lower liner of the lower connecting rod end; 17 - bolt; 20 - bushing of the upper connecting rod head; 22 - cup of the crosshead; 23 - annular channel; 24 - radial openings of the bushing; 25 - axial openings; 26 - radial openings of the crosshead.

fastening of the cylinder to the crankcase, so that it may freely rotate on the body, and of a brass head with valves (2). The head is fixed to the body when red heated with use of tin solder. The flange is freely set on the

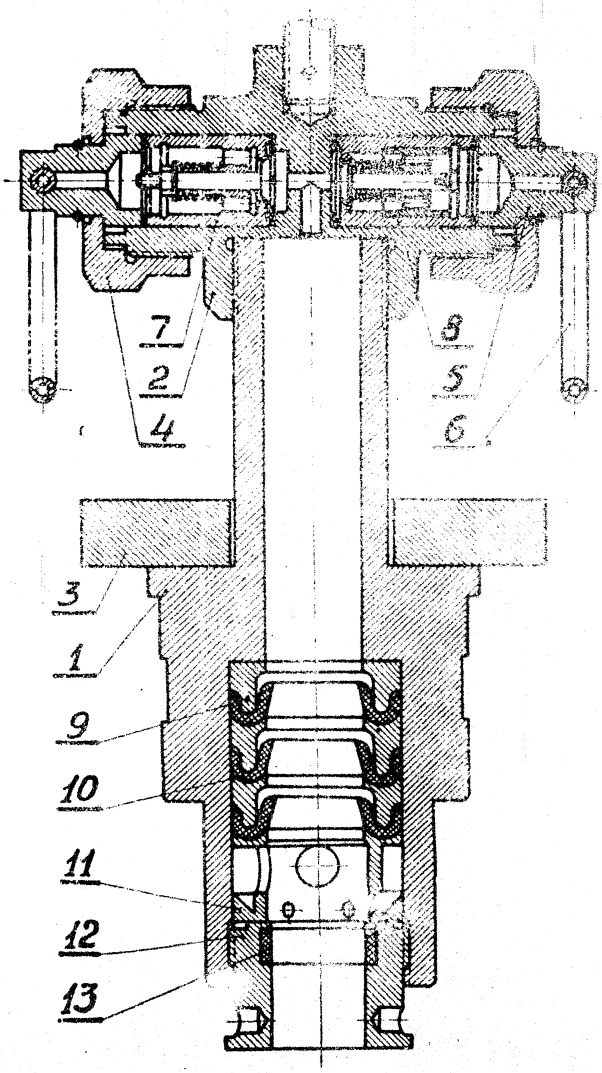


Fig. 13. The cylinder.

1 - body; 2 - head; 3 - flange; 4 - sliding nut; 5 - nipple; 6 - collector; 7 - sucking valve; 8 - expelling valve; 9 - packing ring; 10 - leather cup; 11 - distance ring; 12 - brass coupling nut; 13 - stuffing box.

cylinder and cannot be removed from the cylinder without unsoldering the head. From outside, the cylinder is zinc-coated.

In the lower part of the cylinder a hole is drilled for the fastening of the cups; through this drilling three leather cups are inserted (10) with brass packing-rings (9) and a distance ring (11) which are provided with openings for the lubrication of the plunger piston. All the rings are kept down by a brass-nut (12), which is fitted with a felt washer at the connection with the plunger piston (13).

The valves (7 and 8) are inserted into special sockets in the head of the cylinder and are pressed down by the nipples of the collector (5) and by union nuts (4). The sucking valves are placed on the left side of the compressor (seen in the direction of truck movement) and the expulsing valves on the right side.

6. Valves of the compressor.

The sucking valve (Fig. 14) consists of a brass seat (1), in the bushing of which the valve rod moves (2). The valve is turned of anticorrosive steel. The valve-head has a working cone put under the angle of [illegible]° and a slit cut out. On the shank of the rod, there is a brass-disc serving as support for the bronze spring of the valve (4). The disc is fixed into its position by brass nuts (5). The valve opens in the direction to the cylinder.

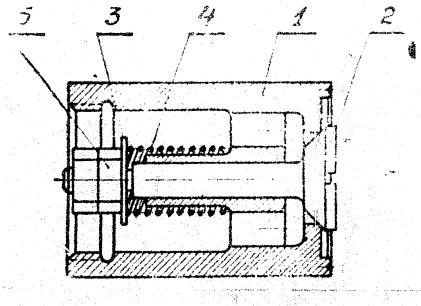


Fig. 14. Sucking valve.
1 - seat; 2 - rod; 3 - disc; 4 - spring; 5 - nut.

The expulsing valve (Fig. 15) differs a bit in its layout from the sucking valve. It opens inside the seat,

consequently the valve-head (2) has another shape and especially its cone base faces the shank. The valve-spring (4) is supported on one end by the valve - head, and on the other by the guiding bush. The guiding bush is held in its socket by a distance ring (5). The material of the components of the expulsing valve is identical with the material of the sucking valve.

7. Pumps.

The pumps for the glycerine and the glycerine-in-water solution (Fig. 8 and 9) of the compressor are placed in a common bronze body: the glycerine pump (15) in its bottom part and the glycerine-in-water solution pump in the upper part. The pumps are gear pumps and they are rotated by a common gear (22), fitted on the front-pivot of the crankshaft. The working gears of the pumps (rotors) are made of rustless steel. The journals of the gears are supported by the walls of the holes, drilled into the body of the pump and in the covers. The end of the journals of the driving gears show out through the lids, and on them small direct gears are fitted, meshing with the common gear (22) of the crankshaft.

8. Elastic clutch.

In order to avoid distortions and bumps, the crankshaft is connected with the rearside of the flexible drive not firmly but by an elastic clutch. The clutch consists of two cast-iron discs and six steel fingers with rubber washers.

The assembly of the clutch cover with the driving disc of the clutch is shown on Fig. 16.

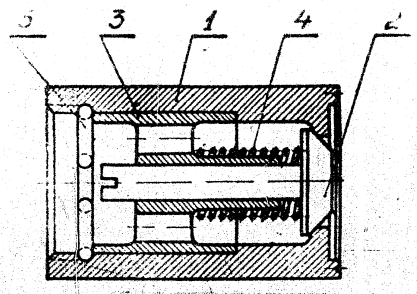


Fig. 15. Expelling valve.
1-seat; 2-head; 3-guiding bush; 4-spring; 5-distance ring.

A steel barrel (14) is pressed into the cast-iron box (8) and two ball bearings are inserted in this barrel (13). A spline shaft (3) is supported by these bearings. A distance sleeve (2) is placed between the inner rings of the bearings, on the shaft. On the right of the bearing, a bush (6) is placed supporting the flange of the universal joint, hermetically fixed to the right end of the spline shaft. The outside ring of the ball-bearing is covered by a cast-iron lid (4) put on a paper insert (16) by four studs.

On the left end of the spline shaft the driving disc of the clutch (9) is set on a dowel (1), attached by a screw (10) to its socket. Axial displacement of the clutch is blocked by a stop screw (12). To avoid the unscrewing of the fastening screw this screw is locked by a spring-ring (11), running through the screw groove.

The ball bearings are lubricated by glycerine from the crankcase of the compressor. In order to avoid a leakage of glycerine through the clearances during the rotation of the spline shaft, there is a gland packing arranged for on the shaft right end.

A normal leather cup (5) is used for the gland packing, well soaked and drawn on a thrust sleeve (6). The stuffing box is fixed with a distance-ring (17) and a flange (18) by two studs (7) to the conical saddle of the lid (4). For the recovering of the drops of glycerine which may eventually leak, a spiral spline with flattened edges is provided on the surface of the thrust sleeve, by which the drops of glycerine are led back into the crankcase while the shaft is rotating.

9. Water cooler.

On the upper flange of the crankcase a water cooler (Fig. 10, 20) is provided in order to cool the cylinders. The cooler has a corrugated iron body and a removable lid. The joints of the cooler and crankcase as well as of the

lid and the cooler are hermetical and provided with rubber insert. The body of the cooler is attached to the studs of the cylinders with the help of cross-arm by normal screws. The lid is put on the same studs and is attached by two wheels from the outside. The cooler is being filled with water from the top, while the lid is

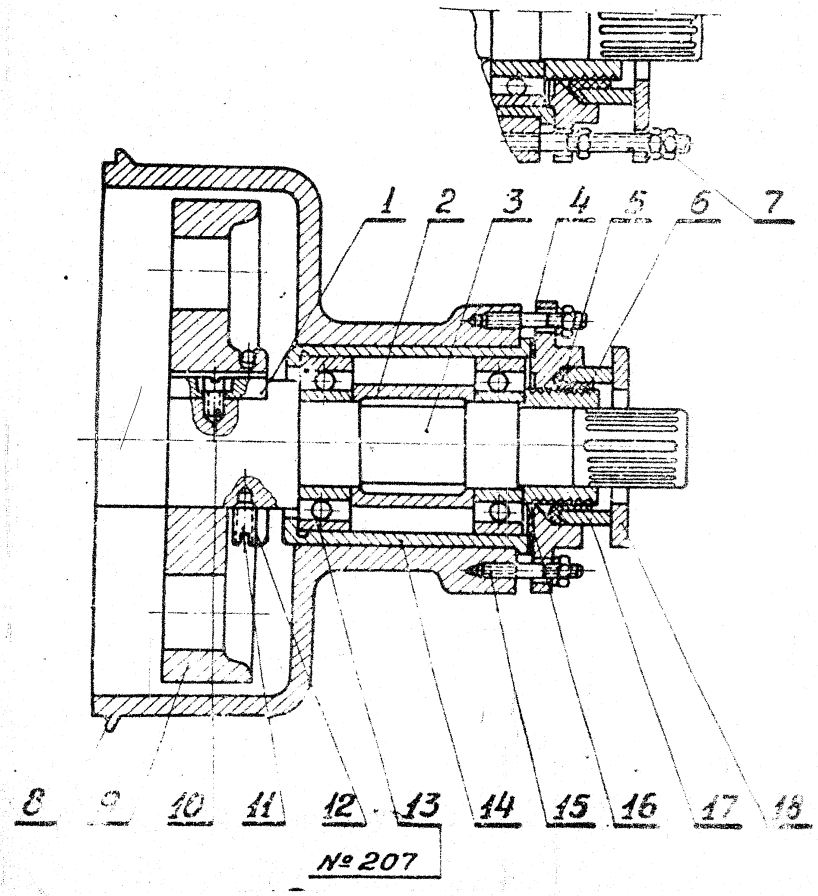


Fig. 16. The cover of the clutch assembly.

1. Dowel
2. Distance sleeve
3. Split shaft
4. Lid
5. Cup
6. Thrust sleeve
7. Stud
8. Box
9. Driving disc of the clutch
10. Fastening screw
11. Spring ring
12. Fastening screw
13. Ball bearings
14. Barrel
15. Stud
16. Washer
17. Distance ring
18. Flange

removed; the water is being let out by an outlet cock.

10. Filters.

There are four filters placed on different places on the compressor, and they require some care when the compressor is in action.

The oxygen filter is placed on the sucking line of the compressor. It is made of brass net No 35/35 openings in one inch/ and a brass body; this filter is placed in the terminal of the sucking collector body (Fig. 8, No 11). For blowing through or rinsing this filter it is necessary to open the union nut of the sucking line of the compressor and to remove the socket.

The oxygen filter on the entering socket of the safety valve of the compressor is made of the same net No 35. It is placed inside the body of the safety valve. For blowing through this filter, it is necessary to take it out of the valve body.

The filter for the glycerine-in-water solution on the sucking line of the pump for this solution has the shape of an extended cup, made of the brass net No 25 (25 openings in one inch). It is soldered to the sucking socket and is put into the removable hatch of the front-wall of the crankcase. If blowing through this filter, it is necessary to open the nipple (28 - Fig. 8). If rinsing this filter, it has to be taken out of the front-wall of the crankcase (Fig. 9, No. 29).

The glycerine filter on the sucking line of the glycerine pump is made in the shape of a lid of brass net No. 25, soldered into the blind brass body. It is set into the body of the pump (Fig. 9, No. 30). This filter may be blown through by opening the plug (Fig. 9, No 29). For rinsing this filter, it is necessary to remove the cast-iron lid of the pump and take the body of the filter out of the socket after having opened the wire lock.

11. Cocks and plugs (Fig. 9).

On the compressor, there are two cocks and six plugs, which are to be used when the compressor is at work. The cock (34) controls the flow of the solution of glycerine-in-water out of the pump and partly out of the reservoir for this solution. Two plugs (35) serve to pour out the remainder of the glycerine-in-water solution of its reservoir. The plug (37) covers the inlet of the reservoir for the glycerine-in-water solution. The thread plug 26, Fig. 9) serves for pouring glycerine into the crankcase. The plug (43, Fig. 12) controls the outlet of glycerine out of the crankcase, it is set below the compressor on the clutch side, on the outer surface of the floor. If letting out the glycerine, it is necessary to open also the small lid of the outlet pipe (44) and rinse out the pipe by pouring twice into the funnel of the trough fresh water. The plug (29, Fig. 9) serves for blowing through the glycerine filter. To let out the glycerine of the glycerine pump, the lower nipple of the glycerine pipe (18, Fig. 9) has to be unscrewed.

VI. THE OXYGEN PIPE LINE AND EQUIPMENT.

A. The oxygen system of the station. (Fig. 17).

The oxygen pipe line connects the battery of cylinders, the compressor, the cooler, the dehydrating equipment and the control panel.

The main lines, forming this system are assembled on the control panel and are divided according to their designation into the following lines:

a. The feeding line, connected with the sucking valves of the compressor through which the oxygen is sucked up by the compressor.

b. The expelling line, connected with the expelling

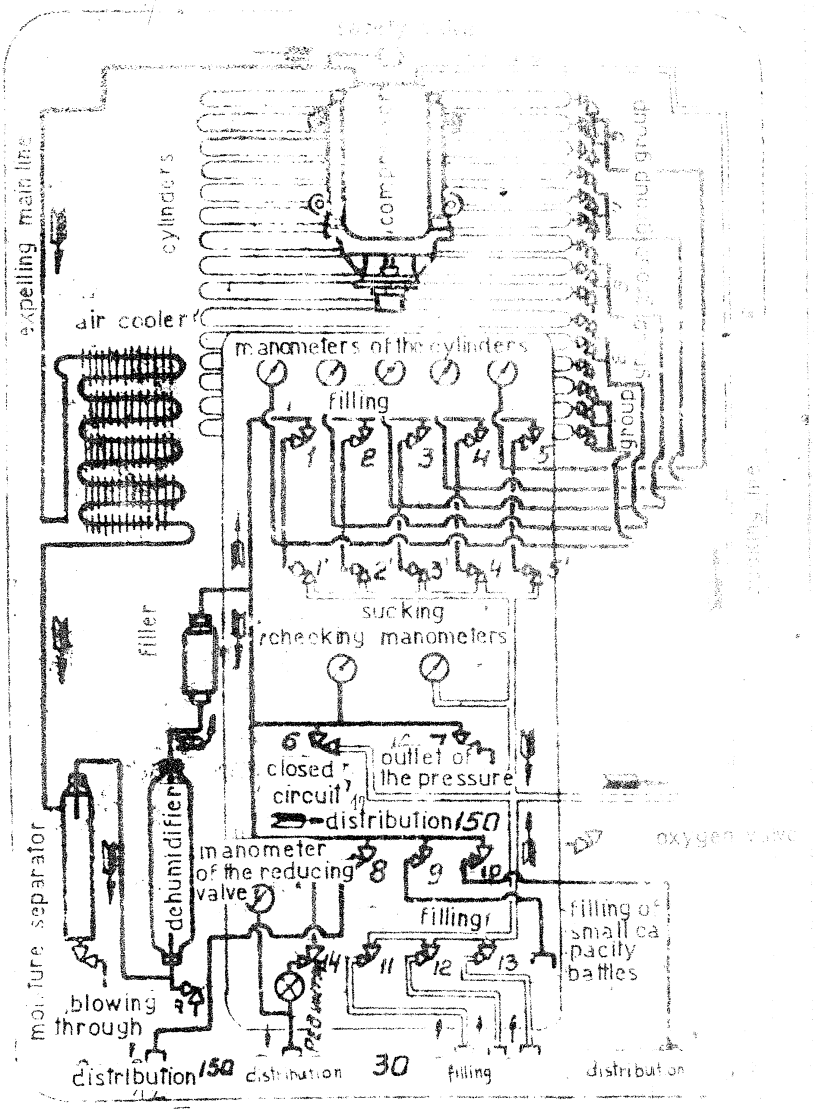


Fig. 17. Scheme of the oxygen pipe system.

1, 2, 3, 4, 5 - valves of the expelling line

1', 2', 3', 4', 5' - valves of the feeding line

6 - valve of the closed circuit

7 - valve of the pressure control

8, 10 - valves of the distribution of oxygen at 150 atmospheres

9 - valves for filling of small capacity bottles from the socket of the control panel

11, 12, 13 - valves for filling the station

14 - valve of the distribution of oxygen at 30 atmospheres through the reducing gear

valves of the compressor through which the oxygen is driven from the compressor into the circulation.

c. The distributing line, connected with the distributing sockets on the outside of the body, through which the oxygen is distributed into the cylinders on board of the aircraft. As long as the compressor is distributing oxygen into the cylinders, this line acts as an extension of the expelling line.

d. The filling line connected with the filling sockets on the outside of the body, by which the station cylinders are filled, by driving the oxygen into these cylinders. As long as the compressor is filling the station cylinders, this line may be considered as an extension of the feeding line.

The same denomination is used for the instruments, installed in the respective lines, for instance, feeding valve, filling socket, expelling collector etc.

The battery of 15 oxygen cylinders is divided into 5 groups, each of 3 pieces. Each of these groups is connected with the panel and has its own manometer and valve on the force and feeding lines of the panel. The valves of the expelling line are arranged in the upper row and marked in the diagram with Nos 1, 2, 3, 4, 5. The valves of the feeding line form the second row and are numbered by Nos 1', 2', 3', 4', 5'.

The feeding line is connected with the sucking collector of the compressor; the expelling collector of the compressor is connected with expelling line of the panel, this line passing the cooler, the moisture separator, the dehumidifier, and also the compensating safety valve. If the pressure in the expelling line is increased, the safety valve opens and the remaining pressure is driven into the sucking main line. The pressure in the expelling line is measured by the central lefthand manometer, the pressure in the feeding main line by the central righthand manometer. The measurements from the manometers are duplicated by measurements read of the group manometers (upper row).

It is possible to pump the oxygen through the feeding and expelling lines from one group of cylinders into another one. So, for instance, if the valves No 2 and No 3 are opened, the compressor will suck oxygen out of the cylinders of the second group through the feeding line and feed it through the expelling line into the cylinders of the third group.

The feeding and expelling lines are linked together by the closed cycle valve No 6 (in the third row on the left). This valve is used when it is necessary to cut off temporarily the feeding of oxygen without stopping the compressor. In this case, the valve No 6 and any valve of the feeding group, for instance No 5 are opened. The compressor in such a case will suck out the oxygen from the cylinders of the fifth group through the feeding line, and the valve No 6 returns back, i.e. it will close the cycle without increasing the pressure in the main line.

The expelling line may be connected with the distributing line (the fourth row of valves).

The valves No 8 and No 10 of the distributing line serve for feading the oxygen to the distributing socket of the station, which are placed on the outside of the body, and the valve No 9 for filling the small capacity bottles through the socket of the control panel.

The feeding line is connected with the filling line (the lower row of valves). The valves of the filling line Nos 11, 12 and 13 are connected with the filling socket, placed on the outside of the wall of the body, and serve for charging the cylinders of the station from external container through by-passing, or from the compressor. From the expelling line a branch-pipe leads to the pressure reducing gear, with the valve No 14. This reducing gear enables the filling of low-pressure cylinders up to 30 atmospheres through a special socket on the outside of the body of the station. The decreased pressure is controlled by a manometer on the control panel (the

lower one on the left, known as "Manometer of the reducing valve".

The filling and distributing lines are connected to each other through the valve of the closed cycle, so that it is possible to feed from the filling sockets to the distributing sockets.

The oxygen is being discharged from the main line through the outlet valve No 7 (on the right in the third row). The oxygen is let out into the atmosphere through a pipe protruding under the body.

2. Description of the construction of elements of the oxygen circulation.

1. Control panel (Fig. 18).

The scales of all the instruments as well as the hand-wheels of the valves are installed on the frontside of the control panel. The instruments and the lines are attached on the rearside of this panel.

In the upper row of the control panel, five manometers are placed, which indicate the pressure in each group of the battery cylinders. Beneath them, there are five valves of the expelling main line (1, 2, 3, 4 and 5). Below them, there are five valves of the feeding main line (1', 2', 3', 4' and 5'). In the center, there are two manometers showing the over-all pressure in the system; on the left - that of the expelling line and on the right one - that of the feeding line. Beneath them, in the centre the scale of the aerothermometer is fixed, indicating the temperature of the glycerine in the crankcase of the compressor. In the third row from the bottom, there are two valves: on the lefthand the valve of the closed cycle (6) and on the righthand the outlet valve (7). In the next row, in the descending order, valves of the distributing main line are to be found, the outer ones of which (8 and 10) are

destined for the distributing sockets on the body of the station, and the central one (9) - for filling of the little capacity cylinders through the socket on the control panel. In the same row, on the left from the valves, there is the manometer of the pressure reducing valve, and on the right - the dial of the electrospeedometer, indica-

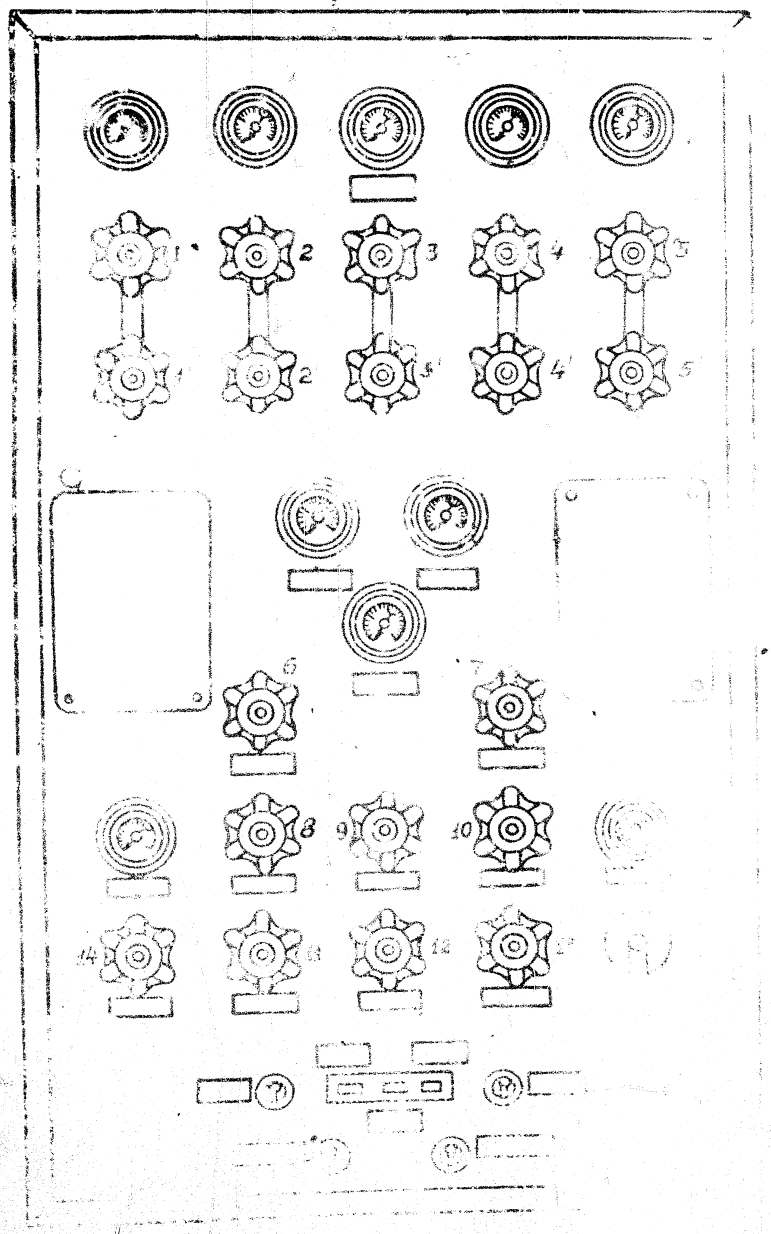


Fig. 18. View of the control panel.

ting the number of revolutions of the compressor. Each small point of the scale of the speedometer is equivalent to about five revolutions of the compressor. The number eight corresponds to 200 revolutions of the compressor. In the bottom row, there are three filling valves (11, 12 and 13), driven out of the filling sockets which are on the outside of the station's body, on the right of the door. On the lefthand from the filling valves is placed the valve of the pressure reductor, and on the righthand - the socket for filling the little capacity cylinders (directly on the control panel).

The lowest part of the panel is occupied by three press-buttons. The left and the central knobs serve the light signalling to the driver's cabin. If the central button is pressed down, a green light is switched on on the driver's panel, and this means a signal for the starting of the compressor. The left press-button switches on the red light, which is a signal to stop the compressor. The righthand pressbutton closes a primary winding of the induction coil with the station's body, the breaker is switched out of action, and the motor stops instantly. Three switches serve to turn on and off the respective roof lights, the fourth one - for cutting off the duplicating sound signalization, when there is no need for it. In the central part of the panel, at both sides, large plates are fixed, the plate on the right - contains a scheme of the oxygen circulation, and the one on the left - a short instruction about observing of safety precautions on the station.

A photographic scheme of the oxygen system is fixed into the control panel, which is corresponding to the scheme on Fig. 17 of this booklet.

2. Moisture separator.

The moisture separator serves for the separation of particles of water carried about by the oxygen. It con-

sists of a steel pipe in the frontside of which a head and a small bottom are welded in. A flanged socket (1) with the guiding pipe (2) and the central pipe (3) of the exit socket is connected with the head. The oxygen valve KV - 1 M, serving for blowing the moisture separator through, is screwed into the small bottom. The moisture separator is mounted on the rear-side of the control panel.

The hot oxygen coming out of the compressor contains a certain amount of moisture in the form of vapour. Passing through the air-cooler and along pipe line, the oxygen is cooled and the water vapeurs, contained in it, are condensing in the form of very fine drops which remain nevertheless in suspension. In the moisture separator the oxygen flow starts owing to the directing pipe (2) a spiral rotation. The moisture particles are, through the action of the centrifugal force, thrown against the walls of the cylinder and are flowing down these walls. This process is helped also by an abrupt change of speed and direction of the oxygen flow. The oxygen, freed of the drops of moisture, flows through the central pipe (3) with a collar to the exit socket and threfrom further to the dehumidifier. The water dripped on the bottom is periodically removed through the blow-off valve of the moisture separator (5).

3. The dehumidifier (Fig. 20).

The purpose of the dehumidifier is the final drying of oxygen, it means the absorbing of water vapours, which remained in the oxygen after its passage through the moisture separator.

It consists of a double-neck steel cylinder (1) with a capacity of four litres. Into the lower neck of the cylinder the entering socket (2) is screwed in with a netting filter (3) and a traverse with a blow-off valve of the type KV-1M. Into the upper neck the exit socket (5) is screwed in with the same netting filter (6). The whole

interior of the cylinder is filled with SILICA GEL (silicic acid with 10% moisture) Mark KSM according to Standard 3956-47. The dehumidifier is also mounted on the rear-side

1. Flanged socket
2. Guiding pipe
3. Central pipe
4. Cylinder
5. Blow-off valve

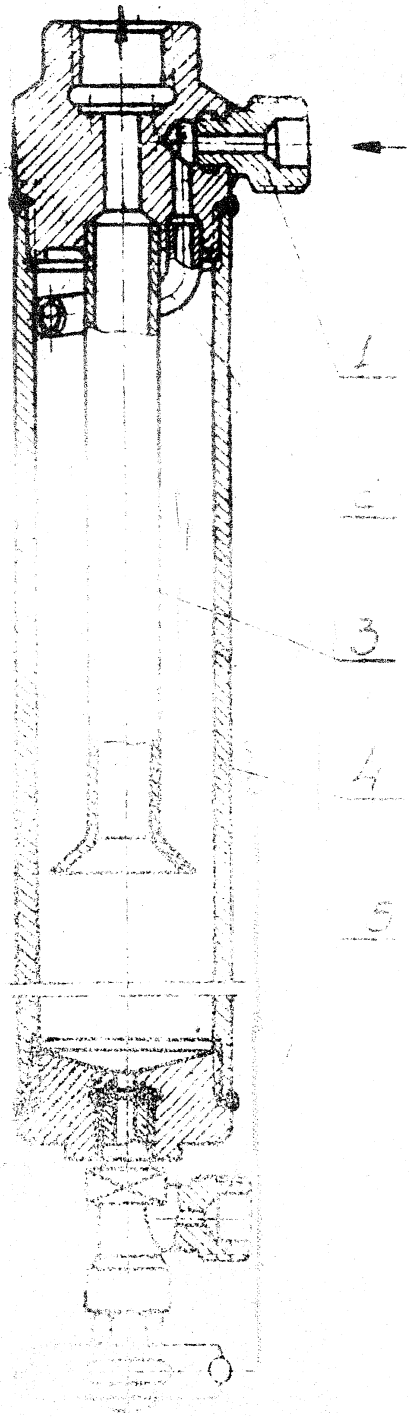


Fig. 19. Moisture separator.

of the carcass of the control panel.

The motion of the dehumidifier is based on the high absorbing power of silica gel, it means on its ability to absorb easily water vapours, contained in gases. Owing to that, the relatively wet oxygen, passing through the layer of silica gel, is by this way dried to an extraordinary low content of moisture (theoretically, in favourable conditions, to 0,03 grammes of moisture in one cubic meter of oxygen).

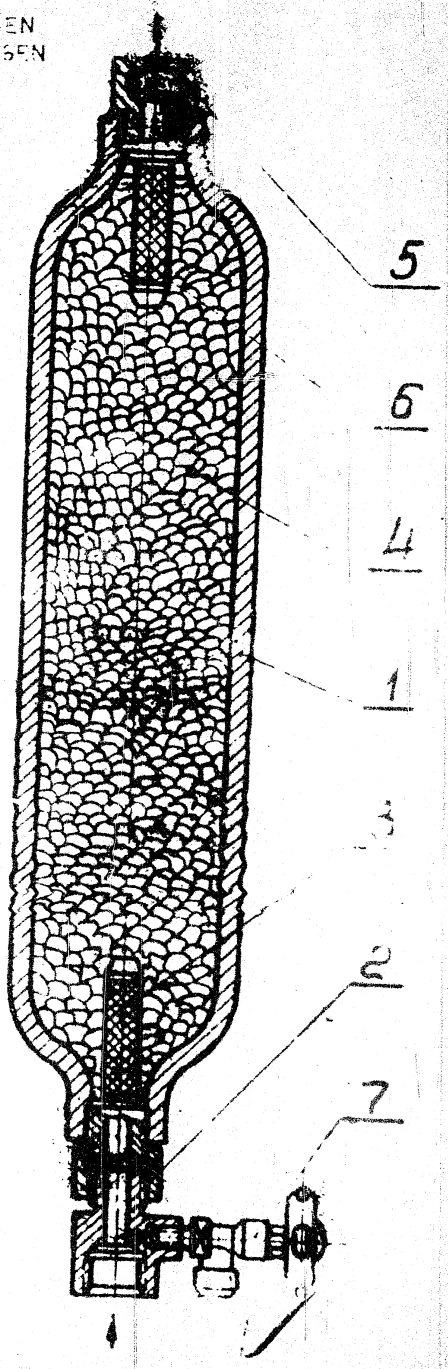
In the run of time, the silica gel gradually moistens, its absorbing power decreases and may completely vanish. Nevertheless wet silica gel may be heated at a temperature of 180° - 200° Centigrades and regenerated in this way, so that it is again well able to absorb moisture. In normal working conditions of the station AKZS-40, the saturation of silica gel with moisture takes place approximately after 24 hours of action. After this term, it is necessary to exchange the silica gel or to heat treat it (observing of course all safety precautions against pollution by caustic materials).

It is important to note that at an oxygen temperature above 40° Centigrades, practically no drying of oxygen takes place, and the oxygen passes through the silica gel unchanged, as far as moisture is concerned. It is therefore, on hot summer days, necessary to take suitable measures for an additional cooling of the oxygen, e.g. to change more often the water in the water-cooler of the compressor, to provide an air-draft above the air-cooler, to wet the oxygen circulation main line etc.

In order to prevent that the oxygen, flowing out of the station, is spoiled by fine particles of silica gel, carried away off the dehumidifier by the flow of oxygen, there is an outcarrying ceramic filter, installed in the main line behind the dehumidifier.

Page 47: Fig. 20. Dehumidifier.

EXIT OF OXYGEN
ENTRY OF OXYGEN



1. cylinder
2. entering socket
3. entry filter
4. silica gel
5. exit socket
6. exit filter
7. blow off valve

EXIT OF OXYGEN
ENTRY OF OXYGEN

This filter is fixed on the control panel above the dehumidifier. A bit lower, the inlet of the filter is connected by a pipe with the exit socket of the dehumidifier, and the upper outlet with the expelling main line of the control panel.

The body of the filter (Fig. 20 a, 1) is made of an open steel cylinder with an extension. Into this body a plug (2) is screwed on, to which a hollow ceramic barrel (3) is fastened by a split pin locked nut (5). The front side surfaces of the barrel are packed by leather washers (4) and the plug is pressing on the body through a cupper washer (7). The nut of the barrel (5) is of a tetrahedral shape. The edges of the nut are guiding the barrel in the body, and the joint between the edges of the nut and the wall of the body enables the oxygen to flow through the entry-opening into the space between the body walls and the filter barrel. Thanks to the packing, the oxygen flow may proceed from the entrance opening of the filter to the outlet only through the pores of the ceramic barrel, by which a thorough cleaning of the oxygen from mechanic intrusions is achieved.

4. <u>The oxygen valve of the control panel</u> (Fig. 21).

On the control panel there are normal high pressure oxygen cylinder valves with a diaphragm packing of the type "KVB-46M". The outside surface of the valve is prepared for the fastening of the valve on the control panel by some additional finishing, a thread is cut into the body of the valve, on which a flange (10) and a clamp nut (11) are wound. The thread terminal of the normal valve is cut off to the short collar. The flat handwheel of the normal valve is substituted by a more suitable one for the task, i.e. by a profiled carbolite fly-wheel (5). The valve is provided by two sockets: the lower one (1) for the inlet of oxygen, and the second one on the side (2) for the outlet. The opening of the lower socket has the

shape of a seat closed by a brass-valve (3) with an ebonite cushion. The valve is kept open by a short strong spring (9). It closes through the rotation of an spindle (4), into which a ball (13) is rolled, which is supported by the terminal of the valve by means of a cushion (12)

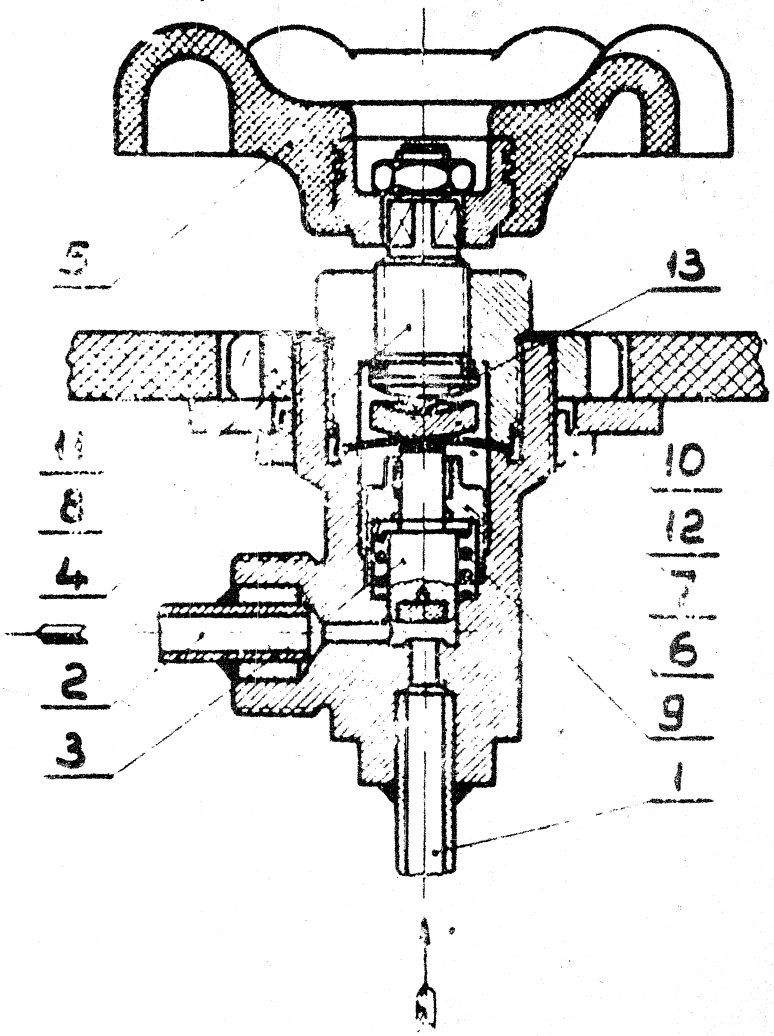


Fig. 21. Oxygen valve.

1. Oxygen entry socket
2. Oxygen exit socket
3. Valve
4. Arbor
5. Flywheel
6. Plug
9. Spring
10. Flange
11. Clamp nut
12. Cushion
13. Ball

spring loaded, without lever, with the gas pressure acting below the valve. The reducing valve has two chambers: the high pressure chamber "A" and "B", the low pressure chamber. The high pressure chamber, directly behind the valve (Fig. 17, 14) is connected with the expelling main line and works with the same pressure. The low pressure chamber is connected through a pipeline with the distributing socket, placed on the left side of the body. The pressure in the distributing low-pressure socket is measured by a manometer. In order to prevent an accidental excessive increase of the pressure in the low pressure chamber, a safety valve (1) is established, which is regulated for the beginning of the leakage to a pressure not lower than 33 atm. and for the fuel leakage to a pressure not exceeding 40 atmospheres. The low pressure chamber is tightly closed by a metal diaphragm (2). Inside the low pressure chamber, between the diaphragm (2) and the plain slide valve (3), there is a washer (4) with a pusher (5). On the outside of the diaphragm (2) there is a thrust washer (6), a spring (7) and a regulating screw (8). At the starting moment of the reducing valve, when the pressure in the low-pressure chamber "B" is lower than 30 atmospheres, the high pressure oxygen moves aside the plain slide valve (3) and flows from the chamber "A" into the chamber "B". The pressure in the chamber "B" rises. In consequence of this, the pressure of the diaphragm against the spring (7) also rises, the diaphragm will straighten, the washer (4) with the pusher (5) and the plain slide valve (3) are shifting the action of the spring (9) sidewards of the diaphragm, closing the opening in the valve seat (12) and reducing the oxygen flow from the chamber "A". When the pressure in the chamber reaches 30 + 4 atmospheres, the gas-flow into the chamber stops, since the plain slide valve (3) closes the opening in the valve seat (12). The spring (7) is regulated by the screw (8) so that the plain slide valve (3) closes the opening in the valve seat (12) at a pressure in chamber "B" of 30+4 atmospheres. If the oxygen is flowing away, it

this reason the pressure on the diaphragm (2) decreases as well, and the spring (7), acting on the washer (6) bends the diaphragm (2); the diaphragm moves the plain slide valve aside from the ring of the valve seat, so that the gas may flow below the diaphragm (2). If the gas-flow decreases during the work, the pressure in the low-pressure chamber increases.

Simultaneously, the pressure on the diaphragm is increasing so that it overwhelms the effort of the spring (7) and flattens the diaphragm (2), so that the plain slide valve (3) covers under the action of the spring (9) the opening reducing the flow of oxygen out of the high-pressure chamber into the low-pressure chamber. If the flow of oxygen is completely stopped, the plain slide valve (3)

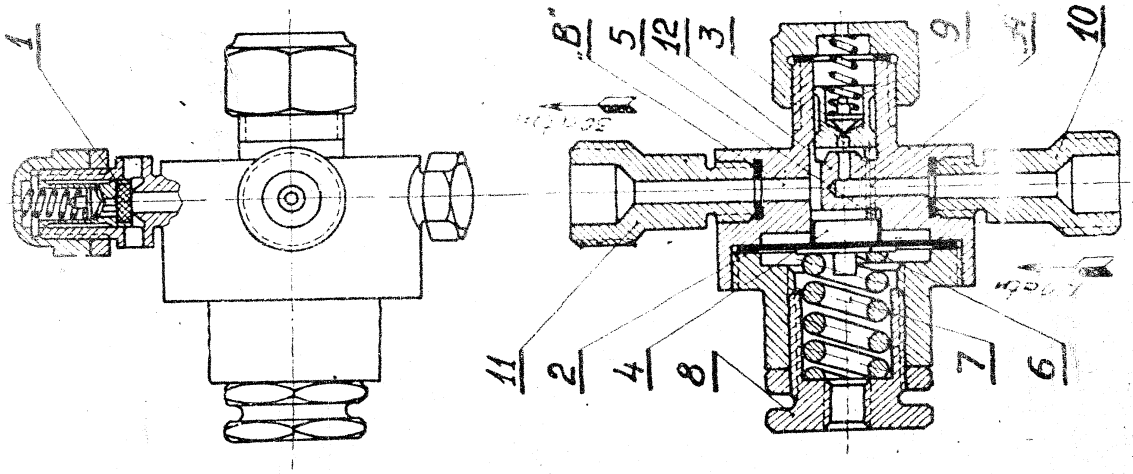


Figure 22.

"A" - High-pressure chamber "B" - Low-pressure chamber

1 - Safety valve; 2 - diaphragm; 3 - plain slide valve; 4 - washer; 5 - pusher; 6 - washer; 7 - spring; 8 - regulating screw; 9 - spring; 10- high-pressure socket; 11-low-pressure socket; 12 - valve seat.

fully closes the opening. When mounting the reducing valve on the control panel, the high-pressure socket (10) is connected with the valve of the reducing valve (Fig. 20, 14), the low-pressure socket (11) with the distributing main line.

6. Battery of oxygen cylinders (Fig. 1).

The station battery is equipped with 15 standart oxygen cylinders with a capacity of 40 litres each and with a working pressure of 150 atmospheres. The cylinders are provided with a normal oxygen valve, packed by a diaphragm. The shoes of the cylinders, installed in the station, ar removed.

The battery is placed in the cylinder compartment of the body, the cylinders are horizontally arranged into three layers and vertically into five rows. The valves of each vertical row are united by a common collector, so that five groups are formed in this way. The line of each group is led to the control panel.

The cylinders are put on special cylinder stands, consisting of a metal frame, forming compartments, fitted with birch linings. The linings surround closely the cylinder, and their surface, facing the upper part of the cylinder, is stuffed with felt. The linings are held in the frame by bolts, one for each lining.

The whole battery of cylinders is tied up by four vertical bolts rigidly connected to the framework of the body.

The battery of cylinders is operated from the right side of the body. A special key serves to make the rotation of the flywheels of the cylinder valves easier.

7. Oxygen pipelines.

The oxygen pipelines are composed of copper pipes with a section of 9 x 5 m/m. The links are formed by threaded nipples and union nuts, and may be disassembled. The

nipples are also soldered to the pipes by a silver solder. The oxygen pipelines from the control panel to the cylinders as well as to the distributing and intake sockets are led on the ground and are protected from mechanical damage by an iron casing.

The intake and distributing sockets of the station are fastened under the casing at the foot of the rear wall of the compressor compartment of the body. On the righthand from the door, there are three intake sockets and one distributing socket at 150 atmospheres, on the lefthand from the door two distributing sockets at 150 and at 30 atmospheres. The engaging ends of the sockets are placed outside. Non-return valves are inserted into the bodies of the sockets of the same kind as the valves in the cylinder heads of the compressor. Pressure delivery valves are fixed into the distributing sockets and sucking valves into the intake sockets. The purpose of the valves is to let through oxygen only in the one direction, i.e. in the distributing sockets - out of the system into the cylinders on board of an aircraft; in the filling intake sockets only - out of the transport cylinders into the circulation. Each socket is closed by a protective nickel-plated cover, fastened on a small chain. Apart of that, each group of sockets is closed from the outside by a common metal casing, which is closed by a clamp, and may be sealed by a lead.

For the connection of the station cylinders to the cylinders on board of the aircraft, the station is provided by flexible copper pipes with a section of 6 x 4 m/m, wrapped around by a spring wire. Three of these pipes are each 3,5 meters long and two - 1,75 meters each. The long and the short pipes may be linked together by a collar nut. Apart from that it is possible to connect three or four of these pipes by special sockets. The short pipes are suspended on the inner front wall of the cylinder compartment of the station's body. The long pipes are placed during the move of the station in covering pipes, which are put along the length-side of the truck chassis. The ends of these covers face the rear wall and are covered by

nickel plated lids. If the station moves only for a short distance, the aircraft pipes are not disconnected from the distributing sockets, being suspended in their center on special small hooks on the rear wall of the station body. In this case, the free ends of the pipes and the special covers of the distributing sockets are connected to the auxiliary sockets for protection against dirt and jamming. There are two auxiliary sockets in each group of sockets. If the auxiliary sockets are used, they should be cleaned of dust beforehand in order to avoid the contamination of the aircraft pipes. The collar nuts of the aircraft hoses are moreover closed by threaded plugs, protecting the pipes against penetrating dust while the station is on move. These plugs must be removed from the pipes before they are connected with the distributing sockets.

The filling of the station batteries by oxygen from transport cylinders is done with the help of the collector of the transport cylinders, fitted with a manometer. This collector consists of a manifold with four branches, provided by collarnuts and connecting nuts on their ends.

For the filling of the small capacity bottles, a special collector for small capacity bottles is provided as well. This collector has also four branches, but it is not provided by a manometer.

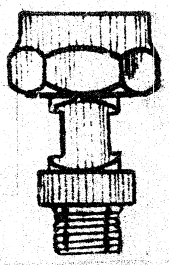


Fig. 23.
Adaptor to the oxygen producing plant

The station battery may be filled with oxygen directly from the oxygen producing plant. In this case the long aircraft pipe is used to which a special adapter is connected (Fig. 23). The free end of the pipe is connected with one of the three filling sockets, and the other one with the adapter - to the distributing socket of the oxygen producing plant. Both collectors are fixed to the cylinder stands and are held by

spring clamps.

To enable a normal maintenance (soldering of parts, exchange of valve bodies etc.) the individual lines on the control panel are assembled as separate units, i.e. lines, connected to each other by thread joints, which may be disassembled. In this way, it is possible to remove a certain unit from the panel disturbing the whole communication.

VII. INSTRUCTIONS FOR USE.

These instructions for use contain the following points:

A. Preparation and starting of the station
B. The operation of the station
   a. Filling with oxygen of cylinders on board of an aircraft.
   b. Filling with oxygen of cylinders on the collector of the control panel
   c. Filling of the station own cylinders with oxyge
   d. Filling of cylinders on board of an aircraft from outside sources
   e. Pumping over of oxygen from one group of cylinders to another one
   f. Filling of oxygen cyliders through the reducing valve
   g. Work in closed circuit
   h. Checking of the safety valve and release of pressure
C. Maintenance and handling of the compressor
D. The work of the drive and switching on of the compressor
E. Routine work

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   g. Work in closed circuit
   h. Checking of the safety valve and release of pressure

C. Maintenance and handling of the compressor

D. The work of the drive and switching on of the compressor

E. Routine work

A. Preparation and starting of the station.

The starting of the station should be divided into two stages, i.e. the preparation for the start and the start proper and moreover it is necessary to take into account whether the station cylinders contain sufficient oxygen pressure (not less than 60 atmospheres) or whether the station cylinders are not filled with oxygen (often there is a small remaining pressure of 10 - 15 atmospheres), and in such a case an outisde source of compressed oxygen is made use of.

It is necessary to pay attention to the difference in the preparation of the station for start in both cases, it means whether the station own cylinders are filled with oxygen or not.

In both cases the station must be in absolute order, the main lines must not be damaged, all the main parts of the station must be on their places. As a rule the compressor must not be disassembled after its assembly at the producer's. The operator must be absolutely sure that there are no particles of oil brough to anyone of the degreased units of the station.

In the negative case, the station must not be started and the defaults must be found out and removed forthwith. The compressor may be partly disassembled and reassembled again as shown in Chapter VII, C, and then its parts must be degreased in this case according to instruction in Chapter VIII.

It is necessary that the operator is well aware, that the leather cups of the compressor may be lubricated only with a solution of 20% of glycerine in water (one part of dynamite glycerine or distilled glycerine with an anti-corrosive addition and four parts of distilled water).

The friction parts of the compressor mechanism are lubricated only with dynamite glycerine or distilled glycerine with an anticorrosive addition, consisting of

2% potassium chromate (K2 Cr 04) and 0,13% sodium hydroxide (NaOH), of the weight of the glycerine, which gives the glycerine a greenish colour.

For the composition of this mixture for every 10 kilos of glycerine 13 grammes of sodium hydroxide (caustic soda) and 200 grammes of potassium chromate are taken. Both chemicals are dissolved in 200 grammes of distilled water and heated to the boiling point. The hot solution is being poured into the glycerine and mixed. If the chemicals did not dissolve completely and a deposit still remains, another 100 grammes of distilled water are added, which are heated to the boiling point, and this water is also poured into the glycerine. The chemicals may be dissolved in a glass, porcelain, enamel or in an painted iron vessel. It is not recommended to use zinc plated or aluminium vessels for this purpose.

The application of greasing oils or caustic substances is strictly forbidden owing to the danger of explosion.

The personnel, entrusted with the preparation and the starting of the station, has to wash carefully hands with soap before beginning this work.

The special clothing of the personnel in attendance of the station has to be clean and not spoiled by oil.

Buckets, funnels and other vessels, used for the pouring in of glycerine and of the solution of glycerine in water have to be clean and degreased.

Preparation for the start (First case).

The station cylinders are filled with oxygen.

1. The glycerine is poured through the plug; the level of the glycerine has to be between the checking notches of the transparent glass (25, Fig. 10.).

2. The lubricant consisting of a solution of glycerine in water is poured in through the plug, placed on the right side of the compressor.

3. Fresh water is poured into the compressor water cooler.

4. All valves on the control panel are closed.

5. The valves of the station cylinders are opened and the pressure in each group of cylinders or in each cylinder of a group are checked on the upper row of five manometers, indicating the pressure in the cylinders.

If it is found out that there is a pressure of 150 atmospheres in all the groups of cylinders, in such a case it is impossible to pump over oxygen from one group of cylinders to another one, and oxygen may be directly filled into the connected cylinders from the station cylinder.

6. The cylinders to be filled are connected to one of the distributing plugs.

7. It is necessary to check up, whether the oxygen communications are hermetical and not clogged. It is also necessary to check up whether the compressor is hermetical, whether no oxygen is leaking through its leather cups, and whether the valves of the control panel are working hermetically and reliably. To check up the hermetical working of the main line and of the compressor, it is necessary to open one of the group valves 1, 2, 3, 4, 5 of the feeding line and the valve (6) - see oxygen distribution scheme of the station Figure 20 and control panel Figure 21 -. Moreover the threaded joints of the pipelines and the plugs of the valves are being washed by soap-water. If soap-bubbles are formed, this fact gives evidence of leakage of oxygen. In order to stop this leakage, it is necessary to tighten the screw joints or to exchange the washer or to disassemble the valve. Nevertheless beforewe start to remove the defects caused by leakage of oxygen, we have to let out the oxygen of the communication and for this purpose, we have to close the group valve and open the outlet valve (7).

8. After all procedures mentioned above, all valves on the control panel are to be closed.

Preparation for start (Second case).

There is no oxygen in the cylinder of the station (see Fig. 17 and 18).

1. Proceed as in points 1, 2, 3, 4, 5 of the first case.

2. The source of oxygen is connected to the filling socket.

3. Further it is necessary to proceed according to point 7 (of the first case) with the only difference that in checking up whether the circulation of oxygen is hermetical, the filling valve 11, 12 or 13 is to be opened, i.e. that of the valves which corresponds to the filling socket to which the cylinder, we intend to fill, is connected as well as the valves 1, 2, 3, 4, 5 and valve 6; but before letting the oxygen out of the pipeline, it is necessary to close the filling valve. Secondly it is recommended to let the oxygen out of the pipeline through the unused distributing sockets, it means through the sockets of the "aircraft pipes"; by that not the group valve but the filling valve is closed.

After having performed all these procedures, close all the valves on the control panel.

4. Open the valves of the station cylinders.

The start (First case).

The station cylinders are filled with compressed oxygen (see Fig. 17 and 18).

1. Open the cylinder valves of any group, for instance of the group one.

2. Open the closed circuit valve 6 (as a security measure).

3. Start the truck engine.

4. Start the compressor, having made sure beforehand, that the leather cups of all the cylinders were loosened, it means that the set nut of the cups was turned for 1 -

1,5 turns. The compressor is to be run idly, i.e. with loosened cups and with an opened valve (6), without any pressure in the pipeline during 10 - 15 minutes, with the aim to soak through the leather cups. Afterwards, the cups are to be tightened as far as possible.

NOTE:

a. § 4 anticipates the starting of the compressor after a longer standstill, during which the leather cups may have been dried out. If the interval in work is not longer than 5 - 6 hours, the compressor may be put on working run after a three minute idle run without previous loosening and soaking of the leather cups.

b. The compressor may be started, if the pressure in the pipeline does not surpass 60 atmospheres. Otherwise it is necessary to let out - before the starting of the compressor - the superfluous oxygen in the pipeline to the atmosphere by opening slightly the outlet valve (7).

While the valve 6 is opened, both central manometers are indicating identically the pressure in the circulation.

5. Open one of the distributing valves 8, 9 or 10.

6. Open the valves of the cylinders on board of an aircraft, which are being filled.

7. Ensure the pressure of the compressor by opening one of the lower feeding valves, for instance No 1 and simultaneously closing the closed-circuit valve 6.

Pressure should be applied to the compressor smoothly and gradually by an even turning of the flywheel of the feeding group valve.

It is necessary to watch carefully the growth of pressure in the cylinder being filled on the lefthand center manometer and also follow the decline of pressure in the emptying cylinder on the upper manometer of the feeding group and on the right center manometer. The cylinders being filled are often provided by their own manometers.

As soon as the pressure drop 3 : 1 is reached, it is

necessary to stop filling from the given group or cylinder or to connect an additional high pressure cylinder. If, while the compressor is working, the lefthand center manometer shows a sudden rise of pressure, which in some instances is during several seconds surpassing even 150 atmospheres, it is necessary to open immediately the closed circuit valve, and simultaneously close the feeding group valve and open the outlet valve 7.

The start (Second case).

There is no oxygen in the station cylinders (see Fig. 17 and 18).

1. Start the truck engine.

2. Open the closed circuit valve 6 (as a security measure).

3. Start the compressor on an idle run, i.e. with valve 6 open and without any pressure in the oxygen circulation. Similarly with the preceding case, if the compressor is started after a long standstill, it is necessary to loosen the leather cups and to run the compressor idly for 15 - 20 minutes with loosened cups, in order to soak through the cups and tighten again the screw as far as possible.

4. To link up the cylinder to one of the filling sockets, for instance to No 11 (this must be done during the time of preparation for start).

5. After the soaking of the cups and tightening of the set nuts, fixing the cups as far as feasible - one of the pressure delivery valves of the group of cylinders being filled, for instance No 2 (upper) has to be opened, while the cylinder valve of this must be opened during the preparation for the start.

6. The filling valve No 11 has to be opened and the oxygen allowed to pass through into the cylinder being filled. The pressure in the emptying cylinder and the

cylinder being filled equalize, but the final pressure will be obviously lower than the initial pressure of the feeding cylinder.

7. The closed-circuit valve 6 isto be closed; from this moment on, the flow of oxygen through the compressor starts. Quite as in the precedent case, as soon as the pressure drops of 3 : 1 is reached, the filling has to be discontinued, the valve of the group being filled has to be closed, and simultaneously the valve of the second group of cylinders or the closed circuit valve opened. The rise of pressure on the manometer of the group being filled (upper row) and on the lefthand center manometer must be watched as well as the decline of pressure on the righthand manometer and on the manometer established directly at the emptying cylinder. At a sudden rise of pressure the same action is immediately to be restored as in the former case. First of all, the compressor must be stopped and switched off, then the valve of the group of cylinders being filled must be closed and simultaneously the closed circuit valve No 6 opened. The valve of the emptying cylinder has to be closed. After having brought the compressor to a standstill, the oxygen is to be let out of its pipeline through the valve No 7, afterwards all the valves on the control panel are to be closed.

B. The operation of the station.

During the time the station fills oxygen in the cylinders or brings the pressure of oxygen in the cylinders to the desired level, it is necessary to watch simultaneously the work of the compressor and of the individual main parts of the station, and especially check the pressure in the glycerine-in-water solution in the chamber and its proceeding in the form of uninterrupted streaks to the plunger pistons. If necessary, the glycerine-in-water solution must be poured into the chamber through

the plug (after an uninterrupted work of four hours not more than 250 grammes are to be added). From time to time, the flow of glycerine to the head should be checked up by unscrewing the gauge of the glycerine line (Fig. 9, 40), on the third cylinder by 1 - 1 1/2 turns round. Watch the level and the temperature of the glycerine in the crankcase on the thermometer on the control panel, and also the temperature of the water in the cooler of the compressor. Change the water if its temperature exceeds 65 - 70°. Do not allow the oxygen to leak out through the valves and joints of the circulation and tighten in due time the set nuts, lowering the pressure beforehand. If it happens that the lubricant is leaking out from below the lids, plugs, stuffing boxes etc., or if water is running out of the valves, remove these deficiencies well in time. If unusual noises or knocks are heard in the compressor, pipeline or drive, suitable measures for finding out their causes are to be adopted and the deficiencies immediately removed; if necessary, the compressor has to be stopped. Check up periodically whether the valves of the control panel, especially the closed circuit valve and the pressure lowering valve are rotating smoothly. During the work, do not allow rush turnings of the valves and turn them smoothly. Lubricate periodically the rods of the valves. If the valves rotate roughly, change their rod and collar nuts by spares. Keep the station spotlessly clean and in perfect order, and do not allow oily or undergreased objects to be brought in.

The filling of the cylinders by oxygen is to be started from the group of the station cylinders with the lowest pressure, and if necessary, proceed to the cylinders with a higher pressure. It is recommended to fill the cylinders with a pressure drop of no more than three, i.e. that the final pressure in the cylinder being filled will be three times as high than in the emptying cylinder. Higher pressure drops may lead to excessive temperature in the cylinders, and consequently to the drying out of the

leather cups and also to strange knocks in the drive. The cylinders are being filled up to the working pressure, it means to 150 atmospheres. It is also to be borne in mind that the oxygen flows into the cylinders in a sufficiently warm state, and after the cooling of the oxygen in the cylinder, its pressure drops a little. For this reason, in order to obtain the full pressure of 150 atmospheres in the cylinder being filled even after cooling of the oxygen at a high outside air temperature, it is necessary to raise a little the pressure on the manometer of the control panel as shown on the following table:

Correspondence of the oxygen pressure in the aircraft cylinders on the outside air temperature.

Temperature of the outside air (in Centigrades)	Oxygen pressure (in atmospheres)
- 10	133
- 5	137
0	140
+ 5	142
+ 10	145
+ 15	147
+ 20	150
+ 25	153
+ 30	155
+ 35	158
+ 40	160
+ 45	163
+ 50	165
+ 55	168
+ 60	170

When the oxygen is driven from one cylinder into another one, the pressure in the emptying cylinder should

not be allowed to drop below 15 - 20 atmospheres, since filling at low pressure is less efficient and liable to produce overheating. Moreover, there should always remain in the cylinder a pressure not lower than 15 atmospheres, even if all the oxygen is let out of the station; it is not permitted to empty the cylinders into the atmosphere, since in such a case the cylinders could be soiled by the air of the outside atmosphere.

If during a long work of the filling station, there is a strong warming up of the oxygen pipeline and of the compressor cylinders, it is recommended to interrupt for a few minutes the filling operation, open the closed circuit valve and let the oxygen cool down a little, and if possible, restart filling from another group of cylinders with cooler oxygen. In this case, the compressor is not being stopped.

If the compressor is switched in at the beginning of the work in a closed circuit, care must be taken that the pressure does not surpass 60 atmospheres in the sucking main line, since the start of the compressor at a higher pressure has harmfull consequences on the mechanism. If before the start the pressure in all cylinders surpasses 60 atmospheres, it is necessary to close all cylinders, let the surplus of oxygen out of the pipeline, allow to remain 60 atmospheres only and start the compressor again at this pressure.

Further the possible variants of the filling of oxygen are treated and instructions for carrying this work out are given.

On Figure 24 - 32 the control panel with its pipelines valves and manometers is diagramatically shown. Each of these figures enables to get a complete image of the movements of the main oxygen flows through the pipelines of the panel during the relative operation in the station.

The outlines of the handwheels of those valves which should be used for the execution of the respective

operation, are shown by thick lines, and the arrows next to them indicate the direction of the rotation of the hand-wheels, i.e. clockwise, the valves are closed, conterclock-wise, they are opened.

By thick lines with the arrows those pipelines are shown, through which the main oxygen supply is directed in perfor-mance of the operation, illustrated by the respective figure.

By the thick lines also manometers areshown, on which the pressure is being checked. The pipes conducting the oxygen to the manometers, are shown by thick lines without arrows.

It is necessary to bear in mind, that in some pipelines, shown by thin lines, the oxygen will be under pressure as well, but in order to enable the reader to discern more clearly the direction of movement of the main oxygen flows, only these lines are drawn by thick lines with arrows.

a. The filling of cylinders on board of an aircraft with oxygen (Fig. 24).

If filling cylinders on board of an aircraft, the hose is being connected by one end to the distributing socket on the station body, and by the second end to the cylinder on board.

Before beginning of the filling operation, the compressor usually works on the closed circuit with the valve 6 of the closed circuit open. In order to start filling, there must be opened the feeding valve of that group of station cylinders, from which the filling is intended (e.g. 2) and the valve of distributing main line, corresponding to the distribution socket, to which the aircraft hose is connected (e.g. 8). All the other valves of the control panel with the exception of the closed circuit valve, remain closed. At this stage, the filling is not yet proceeding, and the compressor will carry on its work on the closed circuit with the pressure being applied to the selected group, i.e. No. 2. The filling of oxygen from the second group into the cylinders on board of the aircraft starts, when the

closed circuit valve 6 is closed. The increase of pressure in the cylinders is to be checked on the expelling manometer (center left). If the pressure in the cylinders being filled rises to the needed level, for instance to 150 atmospheres, the closed circuit valve is opened again, the compressor is transferred on work on the closed circuit, the valve of the main distributing line is closed, and the aircraft hose disconnected.

If the cylinders on board of an aircraft are being filled simultaneously, both valves - 8 and 10 are being opened

b. The filling of cylinders with oxygen on the collector of the control panel (Fig. 25).

If small capacity cylinders are being filled, the cylinder is connected directly to the socket on the control panel, the feeding valve of any group (e.g. 3) and the

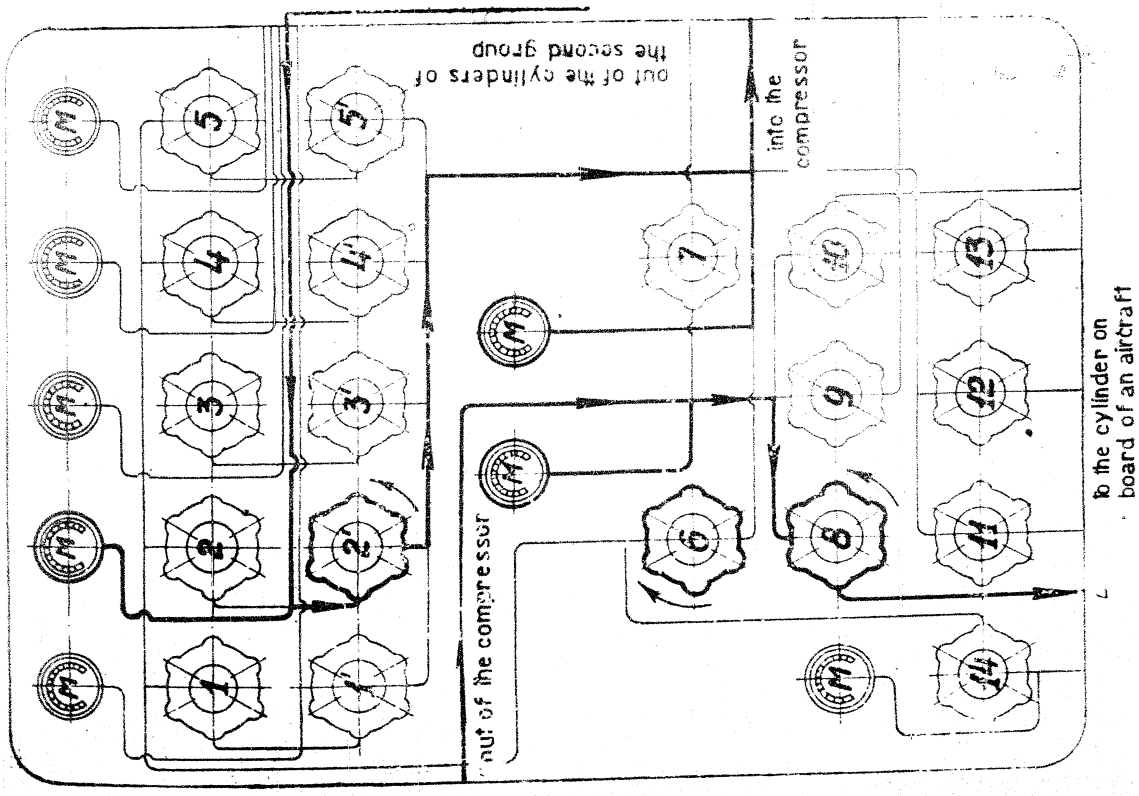

Fig. 24. The filling of cylinders on board of an aircraft with oxygen out of the station cylinders.

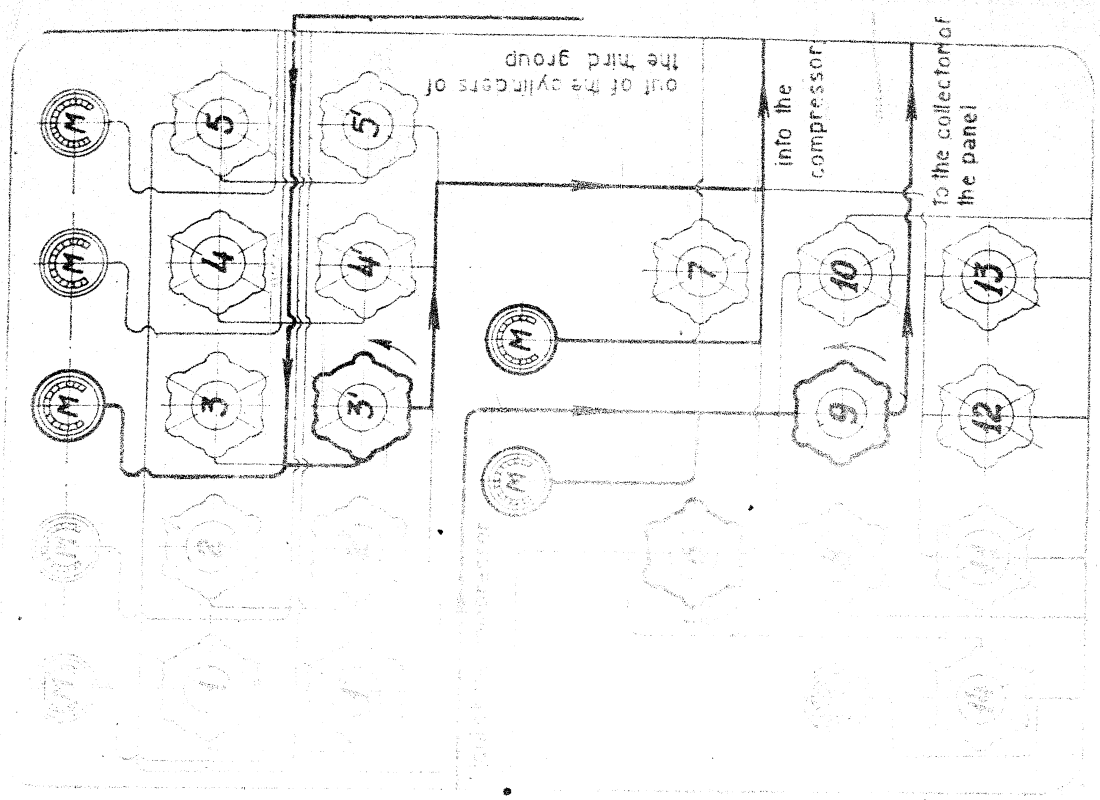

Fig. 25. The filling with oxygen of small capacity bottles through the collector on the control panel.

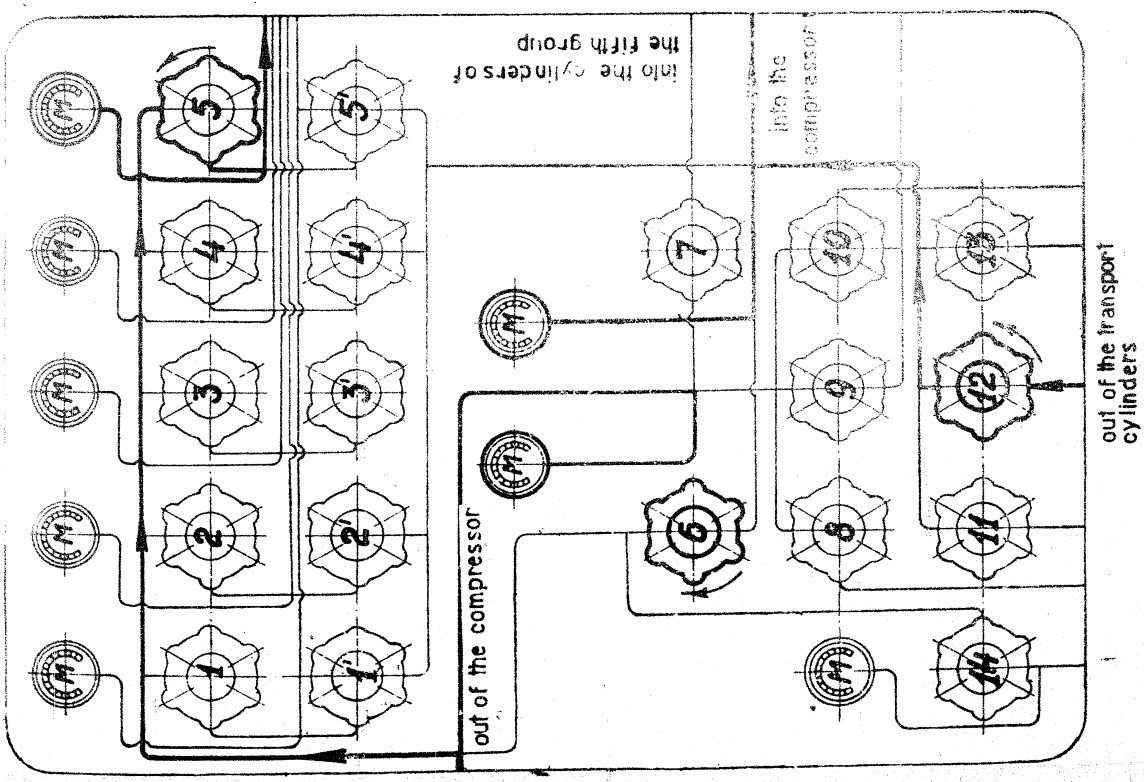

Fig. 26. The filling of the station own cylinders with oxygen.

valve of the main distributing line 9 are opened. Afterwards, the closed circuit valve 6 is closed and the cylinders are filled by oxygen up to the needed pressure, in conformity with the former case.

c. The filling of the station own cylinders with oxygen (Fig. 26).

If the station own batteries of cylinders are being filled, the collector of the transport cylinders is connected to one of the sockets on the station body, and the other end of the collector is connected to four transport cylinders with medical oxygen. The cylinder valves are opened (the valves of the station cylinders battery being filled have also to be opened). On the control panel the valve of the main expelling line of the filled group of cylinders (e.g. 5) and the filling valve of the socket to which the collector with the transport cylinders is connected (e.g. 12) are opened.

With this arrangement the oxygen is flowing spontaneously from the transport cylinders into the filled group of cylinders and the pressure is being equalized. If the compressor works on closed circuit, close the closed circuit valve 6, and allow in this way the flow of oxygen from the transport cylinders into the filled group of cylinders in the same way. Watch the increase of pressure in the cylinders being filled on the expelling manometer or on the upper manometer of the cylinders being filled. As soon as in the group being filled the pressure of 150 atmospheres is reached, close the valve of this group, and simultaneously open the pressure valve of the next group which is prepared for filling, and if no such group is prepared, open the closed circuit valve. The valves must be operated without any delay, otherwise the pressure in the pipeline might suddenly increase.

The oxygen should be driven from the transport cylinders as long as the remaining pressure in the emptied cylinders drops to 10 - 15 atmospheres, and with the pressure drop

not exceeding three. Consequently, for emptying the cylinders to the remaining pressure mentioned above, not one but several successive filling operations may be necessary.

d. The filling of cylinders on board of an aircraft from accessory sources (Fig. 27).

If cylinders on board of an aircraft are being filled from transport cylinders, avoiding the station battery of cylinders, a collector with connected transport cylinders is attached to the filling socket and the distributing socket connected to the cylinders on board of the aircraft by the aircraft hose. The compressor must work - meanwhile - on closed circuit with the valve 6 opened. The valves of the transport cylinder and of the cylinders on board of the aircraft have to be open.

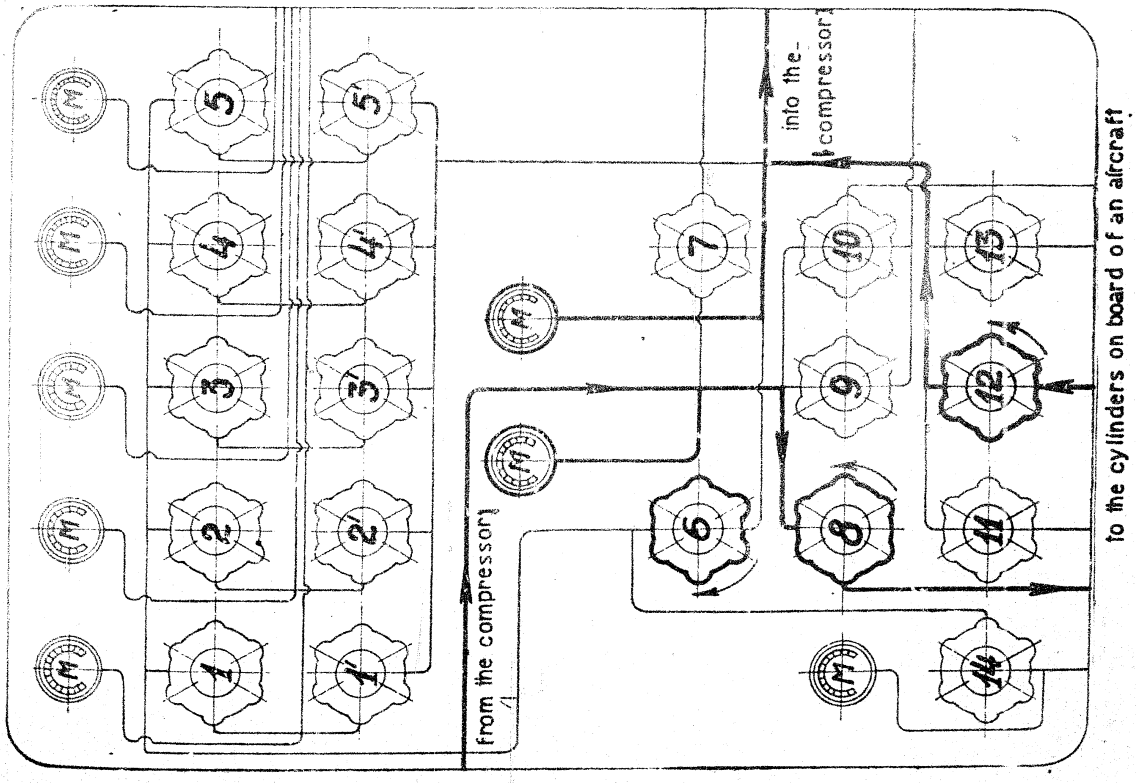

Fig. 27. Filling the cylinders on board of an aircraft from external sources.

Further, the valve of the distributing socket is opened, to which the cylinder on board of the aircraft (e.g. No 8) is connected and the valve of the filling socket, to which the collector with the transport cylinders are being attached, (e.g. No 12). With this setting, the oxygen flows spontaneously into the cylinder on board of the aircraft, fills the whole pipeline, and equalizes the pressure, which will be obviously lower than the required pressure. After having closed the closed circuit valve, the pressure of the oxygen in the cylinder being filled is being completed up to 150 atmospheres, but not surpassing the recommended pressure drop of 3 : 1. Watch the pressure in the cylinder on the pressure manometer. As soon as the required pressure is reached, the closed circuit valve should be closed, and, simultaneously the distribution valve as well.

If a cylinder of greater capacity on board of an aircraft is being filled, it is suitable to connect all four transport cylinders to the collector, otherwise there will be not enough of oxygen and it will be necessary to take it from the station batteries.

NOTE: The present arrangement of the oxygen pipeline of the station does not fill oxygen directly out of transport cylinders into cylinders on board of an aircraft with avoiding the compressor.

e. The filling of oxygen from one group of cylinders to another one (Fig. 28).

This operation is necessary when a considerable part of the oxygen supply of the station batteries has been spent, and in the majority of the cylinders a low oxygen pressure remained. In this case it is suitable, at a time when no filling is going on, to collect this supply of oxygen into one or two groups with a higher pressure by way of a successive filling from one group of cylinders to another one.

At the beginning of the filling operation, the compres-

sor has to work on closed circuit, with the valve 6 opened.

For the filling operation the feeding valve of that group of cylinders, from which the oxygen is to be pumped e.g. 3) is opened as well as the expelling valve of that group, into which the oxygen will be pumped (e.g. 4). As soon as the closed circuit valve 6 is closed, the filling starts and the operator has to watch the pressure in the emptying group as well as in the group being filled, on the feeding and expelling manometers. As soon as the pressure in the group being filled reaches the limit, indicated by the proposed pressure drop three, it means the pressure at which the expelling pressure will be three times as high than the feeding pressure, the valve of the group being filled (4) is to be closed and simultaneously the closed circuit valve 6 is to be opened.

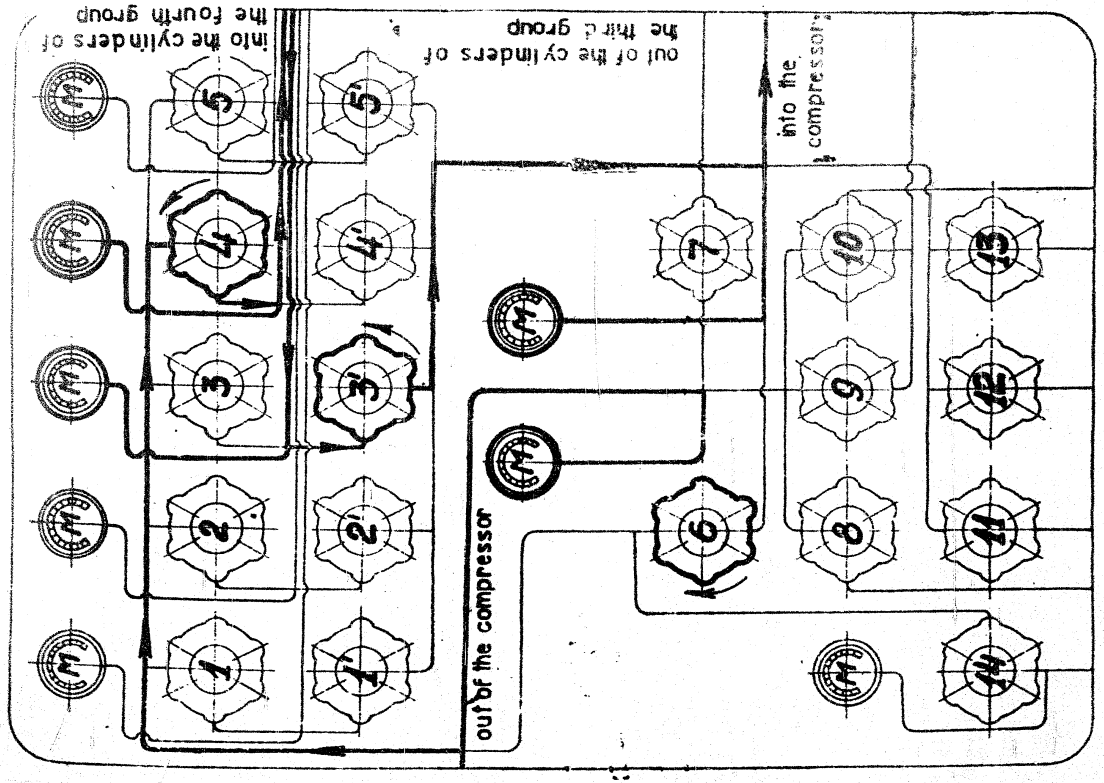

Fig. 28. The filling of oxygen from one group to another one.

The switching over of the valve is to be done simultaneously without any delay, otherwise the pressure in the pipeline may suddenly rise to an unwanted degree.

After having performed several filling operations, the remainder of the oxygen supply may be collected into one or two groups, leaving in the emptied groups the minimum oxygen pressure.

If, for instance, only in the fifth group of the battery there is still full pressure of 150 atmospheres, and in the remaining groups the pressure is equalized to 40 atmospheres, it is possible to obtain after 6 further pumping operations an average pressure in the cylinders as given on the following table (see page 75).

In this table the values of pressure of the groups of cylinders, used for successive filling are underlined.

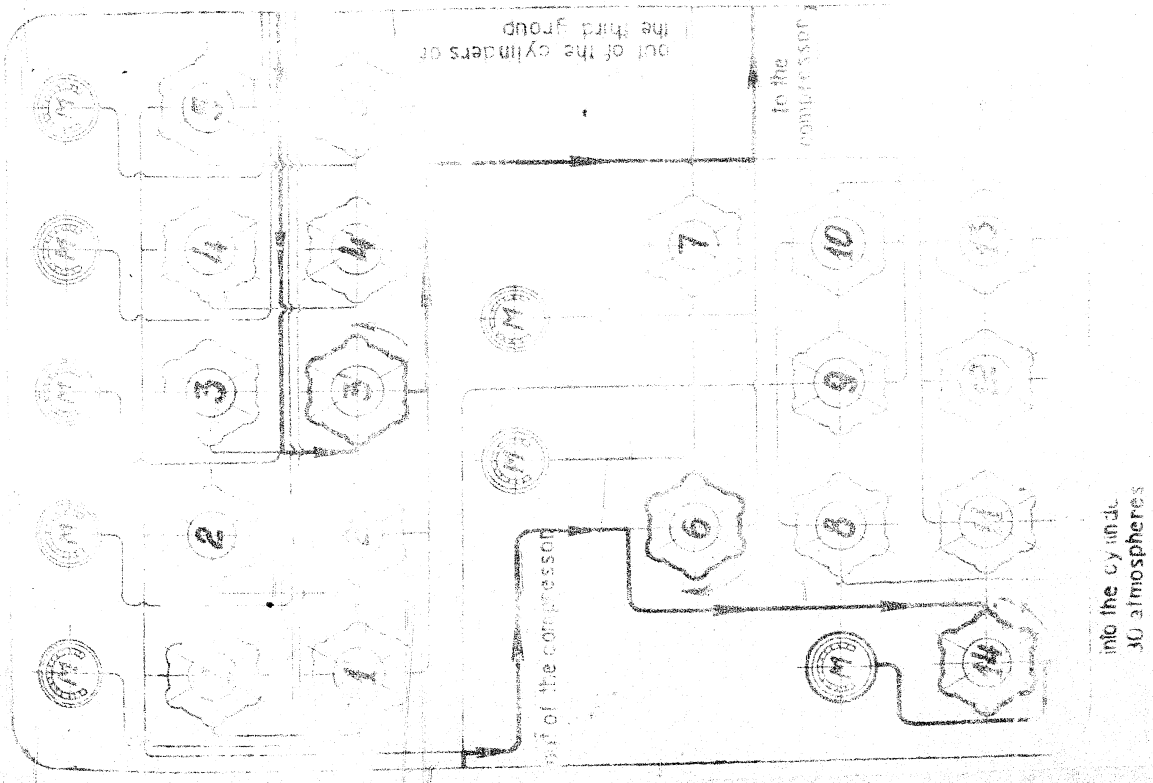

Fig. 29. The filling of oxygen into cylinders to a pressure of 30 atmospheres through the reducing valve.

The filling of oxygen from one group of cylinders to anotherone may be performed in different ways, keeping in mind that the permitted pressure drop must not exceed three. It is recommended to pump the oxygen from a cylinder with a lower pressure into a cylinder with a higher pressure.

The pressure in groups of cylinders (in atmospheres).

Numbers of groups	I.	II.	III.	IV.	V.
Before the first filling	40	40	40	40	150
After the first filling	20	60	40	40	150
After the second filling	20	60	60	20	150
After the third filling	20	30	90	20	150
After the fourth filling	13	37	90	20	150
After the fifth filling	13	43	90	14	150
After the sixth filling	13	33	100	14	150

f. The filling of oxygen into cylinders through the reducing valve (Fig. 29).

For filling oxygen into low pressure cylinders up to 30 atmospheres, a special reducing valve on the control panel is being used, which is adjusted to a pressure of 30 atmospheres on the distributing socket.

For the filling operation, the low pressure cylinder is connected to the socket on the body wall, marked with the inscription "Distribution 30 atmospheres" (the right

socket on the left side).

On the control panel the reducing valve 14 and the feeding valve of that group, from which the filling of the cylinder will be performed, (e.g. No 3) are opened.

If the pressure in all the cylinders of the feeding group will reach at least 40 atmospheres, or with one open cylinder of the group at least 60 atmospheres, the cylinders may be filled directly, without using the compressor. If the pressure in the feeding group is lower, it is necessary to switch on the cylinder, having closed as usually the closed circuit valve.

The pressure in the cylinder being filled is to be watched on the reducing valve manometer (in the lower part of the control panel on its left). After having finished the filling, close the reducing valve 14 and if the filling has been done with the help of the compressor, switch the compressor over on closed circuit work, having opened valve 6.

g. Work on the closed circuit (Fig. 30).

The compressor is working on closed circuit during its start, at short intervals between filling operations and in other instances when the work of the compressor is not needed for filling oxygen or completing its pressure, and, simultaneously it is not wanted to stop the compressor.

For switching on the compressor on closed circuit, the feeding valve of any group (e.g. No 2) and the closed circuit valve 6 are to be opened. In this case the compressor sucks in the oxygen from the cylinders through the feeding main line and expells it again into the feeding main line without increasing its pressure, it means that the oxygen circulates in a closed cycle. For working on closed circuit the group of cylinders with the lowest pressure is chosen, in order not to cause an excessive strain to the compressor, but in some cases it is necessary to work on closed circuit at high pressures.

Work on closed circuit is possible also without switching

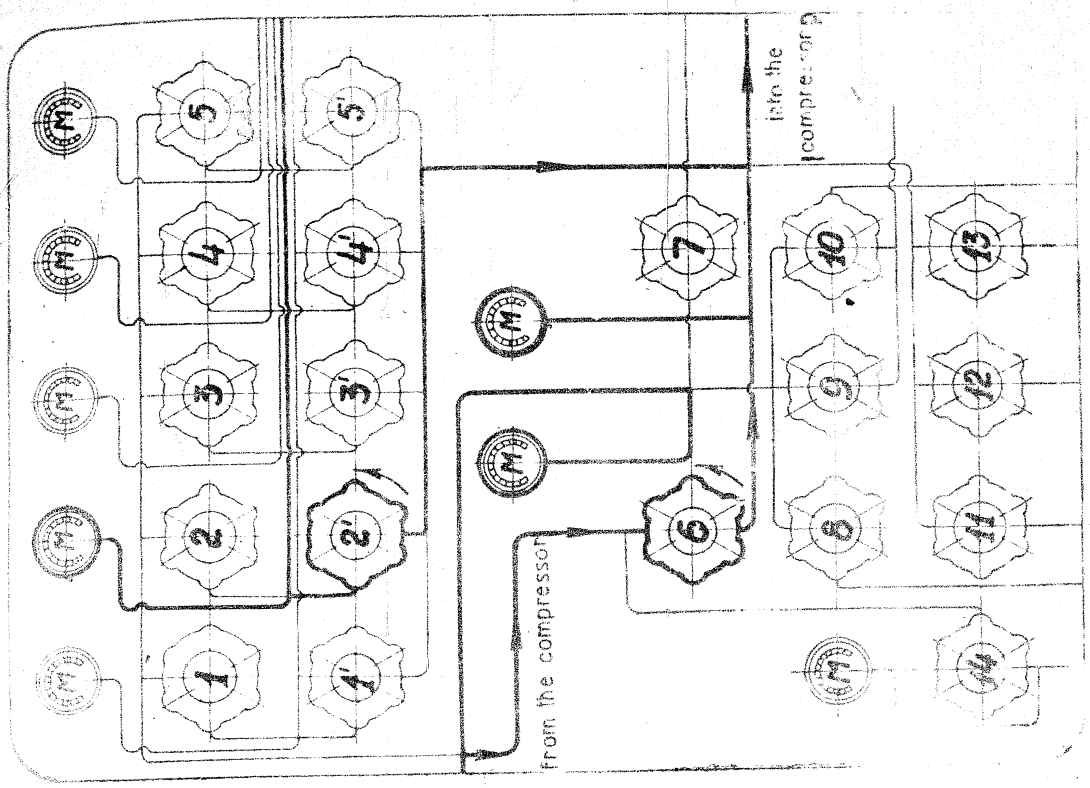

Fig. 30. Work on the closed circuits.

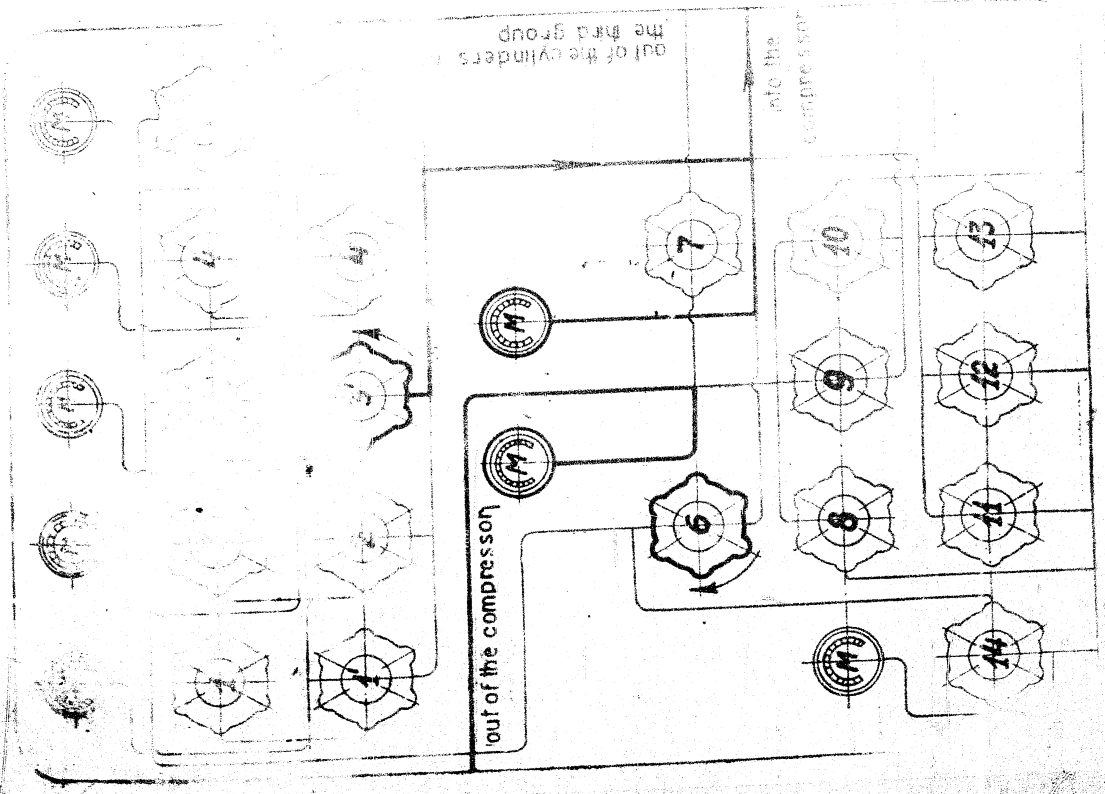

Fig. 31. Check up of the safety valve.

in the feeding valve of any group of cylinders with only one valve of the closed circuit opened. In this case, the compressor will drive the oxygen closed in the oxygen pipeline itself, avoiding the cylinders. This operation is not recommended, since in view of the small capacity of the pipelines, the oxygen will warm up more quickly and if there is some delay in switching over the valves from displacing run to the closed circuit work, when working on the pipeline capacity only, the permitted pressure in the pipeline will be more quickly surpressed.

h. The checking of the safety valve (Fig. 31).

The safety valve is to be checked up before the start of the filling operations in order to make sure about its reliability. If the station works continuously, the valve should be checked up ones per shift.

The checking of the safety valve is being done in the following way: the expelling valves and the closed circuit valve are closed and one valve of the feeding main line with a pressure of 90 - 110 atmospheres is opened.

The compressor is working and the pressure in the pipeline rises to the level of the pressure in the main expelling line, i.e. to 160 - 165 atmospheres with a decrease of pressure in the sucking line to 70 - 60 atmospheres.

The safety valve is due to open itself and to let pass the surplus of oxygen into the sucking main line, not allowing a further increase of pressure in the expelling main line.

When inspecting the safety valve it is necessary to hold the hand ready on the closed circuit valve, in order to be able to open quickly the valve and switch the compressor over to the closed circuit, in case of a deficient safety valve.

i. The lowering of the pressure (outlet of oxygen from the station piping) (Fig. 32).

The decrease of pressure, it means the outlet of oxygen

from the piping may be accomplished by opening the outlet valve 7, or through the moisture separator and the dehumidifier.

In case of acute necessity (sudden increase of pressure in the circulation) the oxygen is let out by opening the outlet valve 7. In this case the oxygen leaves through a pipe under the floor of the station. If the outletting valve happens to be deficient, the oxygen may be let out through the outletting valves of the dehumidifier or of the moisture separator. Moreover, the oxygen may be let out through the distributing sockets by opening the valves 8 or 10, keeping the lids of the sockets open.

If the valves are arranged as shown on Fig. 32, the oxygen leaves out of the whole pipeline and apparatus with the exception of the line connecting cylinders with the

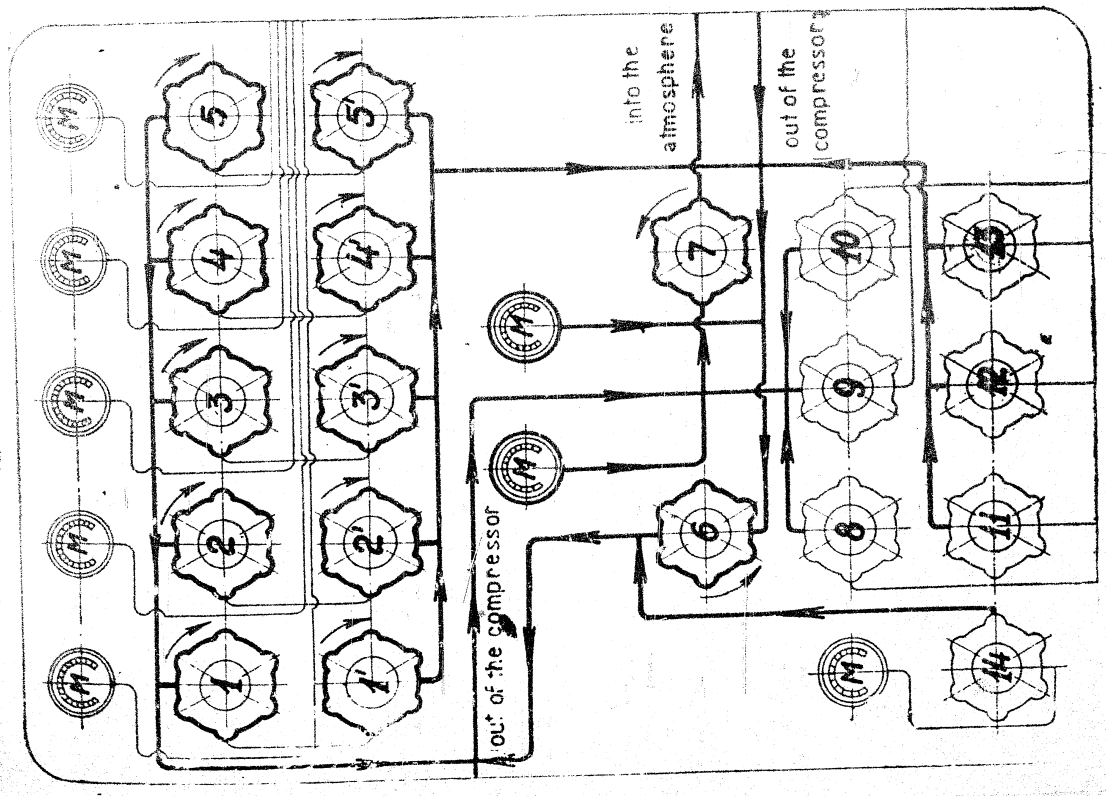

Fig. 32. Lowering of the pressure (letting out the oxygen of the station pipeline through the outlet valve.

group valves and cylinders remaining under pressure. In order to let out the oxygen of this connecting line, it is necessary to open the feeding or expelling valves of all groups, keeping the cylinder valves closed. If it is necessary to let the oxygen totally or partially out of the cylinders, it is necessary to open the valves on the cylinders. While letting out oxygen in order to decrease the pressure in the cylinders, it is necessary to watch the group manometers on the panel. Having reached the required pressure, the operator closes first the group valves on the panel, and afterwards the valves on the cylinders.

It is recommended to let out the oxygen of the cylinders into empty station cylinders, saving the whole oxygen supply of the station and to let oxygen out into the atmosphere only in case of an emergency.

C. Maintenance of the compressor and its operation during the work

1. Preparation of the compressor for the start

Before starting the compressor after a short interval in work (5 - 10 days), it is necessary to check up carefully its outer condition; absence of dirt on the surface, traces of corrosion, leakage of lubricant etc., it is necessary to check up the reliability of the thread joints of the oxygen piping and also the fastening of the removable parts, fixed to the outside, covers, the stuffing box, etc. If the compressor was stored for a longer period before the start, it is necessary to make sure about its good condition and about the suitability of its parts for normal work, of the lack of inner corrosion etc. For this reason, it is necessary to remove and examine the cylinders before the start, and to let the compressor work on idle run without any pressure of the

oxygen.

All parts of the compressor are to be thoroughly degreased before assembling. If the compressor, however, has been in a long period of storage, partially disassembled, rubbed dry or dressed from corrosion, all parts of the compressor have to be degreased in accordance with the inspection instructions.

Before the start, the filters of the compressor are to be taken out, inspected and if necessary blown through; this concerns the oxygen filter on the sucking collector, the filter for the glycerine-in-water solution and the glycerine filter. Glycerine is to be poured into the crankcase, the level of the glycerine has to be between the checking lines, the chamber has to be fully filled with the solution of glycerine-in-water and water has to be poured into the water cooler of the compressor.

Before the start of the compressor, the following valves should be successively blown through: the outlet valves of the moisture separator, the valve of the dehumidifier, the oxygen outlet valve and the whole oxygen pipeline with the valves on the control panel being opened one after another.

2. The servicing of the compressor during its work.

The starting of the compressor for an idle run and the switching over to the working run is being done according to instructions, quoted in the section "A" - "Preparation and start of the station proper", and it is once more reminded that the compressor has to work for 15 - 20 minutes on an idle run with loosened leather cups in order to get soaked these cups through.

At the beginning of the work, it is necessaryto check the action of the safety valve and also smoothness of rotation of the valves on the control panel and their faultless operation.

During the work of the compressor, it is necessary to check the following parts:

1. Check up the even, rhytmical work of the compressor, maintaining a constant number of rotations chosen for the respective kind of work (up to 200 rotations per minute).

If strange knocks or noise are heard, immediately stop the compressor, find out the reason and remove the deficiencies. The work of the station must be reassumed only after the test of the compressor on idle run.

2. Check up, whether there is a sufficient quantity of the glycerine-in-water solution and whether it is fed to the leather cups. This solution has to pass along to the plunger pistons, by a continuous stream. If the supply of this lubricant mixture is stopped by some choking up of the openings of the sprays, it is necessary to clean them with a needle, from the outside, or to open the plugs at the ends of the pipes. If the supply of the solution of glycerine in water is discontinued, the glycerine-in-water main line must be examined forthwith. This is done by a successive opening and cleaning or rinsing of the expelling pipe with the spray, the sucking pipe and the filter. At this occasion, it is necessary to make sure whether there is any supply of glycerine-in-water solution in the chamber. If the flow of the lubricant is not interrupted for more than 3 - 5 minutes, it would not be expedient to stop the compressor, and in such a case, the plunger pistons may be lubricated by hand, by injecting the glycerine-in-water solution with a rubber equirt into the greasing nipples of the leather cups (Fig. 13, 11).

If the supply of the glycerine-in-water solution is interrupted for a longer time, it is necessary to stop the compressor, find out the reason and remove the deficiencies.

3. Watch the level and temperature of the glycerine in the crankcase. The glycerine level has to be between the

control lines of the inspection window. The temperature of the glycerine is shown on the scale of the remote control thermometer on the control panel.

At the normal work of the compressor, the temperature of the glycerine must not surpass 65° Centigrade. The glycerine flow to the crosshead is being checked by unscrewing the plug of the glycerine main line (Fig. 9, 40) on the third cylinder. If this flow is normal, the liquid gets out with strength from the opening of the measuring stick while the plug is being unscrewed.

If the flow of glycerine is interrupted, it is necessary to unscrew the pipe and blow it through (Fig. [illegible]). If the lubricant still does not pass through, the plug of the filter (Fig. 9, 29) is to be unscrewed and the glycerine filter blows through. In the extreme case, it is necessary to stop the compressor and disassemble the pump.

4. If it is shown that the glycerine moistens excessively, i.e. if after four hours work of the compressor a quantity of the glycerine-in-water solution surpassing 250 grammes has to be added, it is necessary:

a. to check up and if necessary to tighten the stuffing box of the glycerine-in-water solution pump,

b. check up whether the lid of the glycerine-in-water solution pump fits to the body, and if necessary, tighten the bolts,

c. check up the condition of the stuffing box in the cover of the bushing and if necessary replace it by a new one. A stuffing box hardened by work may also be the cause of the "whistling" of the compressor.

5. Check up the warming up of the cylinders; the warming up of the cylinders is related to the temperature of the water in the cooler, and if the cooler is removed, the temperature may be ascertained by touching. The water temperature normally does not surpass the temperature of the glycerine in the crankcase, i.e. 65°. The over-

heating of the cylinders in excess of the normal temperature may be caused by a flow of hot oxygen during a considerable time, by defects of the valves; by an uninterrupted prolonged work of the compressor above the permitted limit of the pressure drop. To cool down the cylinders, the hot water must be poured out of the cooler and exchanged by fresh water, and if possible, another group of cylinders with cooler oxygen should be engag for work, or in the extreme case, the compressor should be switched on closed circuit with a lower pressure. The deficient valves are to be replaced by spare valves from the spare parts box.

6. Check up whether the leather cups and the threaded joints of the oxygen circulation line are sealing hermetically. It is possible that during the operation of the compressor cups, which have terminated their warranted service life, or cups which have not yet terminated their warranted service life may for any reason whichever be leaking. The leakage shows itself in form of line insignificant bubbles. At this stage, the leakage has no visible influence on the working of the station and does not cause a loss of noticeable quantities of oxygen. But the formation of bubbles may progress and may be accompanied by a weak sizzling of the oxygen trying its way through. In this case it is already necessary to repair the leakage. This is normally done by soaking the cups which are slightly loosened by a short idle run of the compressor. For this reason, it is necessary to switch over the compressor on idle run, loosen the cups by 1 - 1 1/2 turns about of the clamp nut and let the compressor go on idle run with loosened cups for 10 - 15 minutes, in order to have the cups soaked properly through. Afterwards, with the compressor still on the idle run, the cups are to be tightened as far as possible and the pressure tested. If the leakage occurs again, it is necessary to repeat this soaking procedure ones more.

A stronger leakage, accompanied by a strong sizzling,

heating of the cylinders in excess of the normal temperature may be caused by a flow of hot oxygen during a considerable time, by defects of the valve: by an uninterrupted prolonged work of the compressor above the permitted limit of the pressure drop. To cool down the cylinders, the hot water must be poured out of the cooler and exchanged by fresh water, and if possible, another group of cylinders with cooler oxygen should be engaged for work, or in the extreme case, the compressor should be switched on closed circuit with a lower pressure. The deficient valves are to be replaced by spare valves from the spare parts box.

6. Check up whether the leather cups and the threaded joints of the oxygen circulation line are sealing hermetically. It is possible that during the operation of the compressor cups, which have terminated their warranted service life, or cups which have not yet terminated their warranted service life may for any reason whichever be, leaking. The leakage shows itself in form of line insignificant bubbles. At this stage, the leakage has no visible influence on the working of the station and does not cause a loss of noticeable quantities of oxygen. But the formation of bubbles may progress and may be accompanied by a weak sizzling of the oxygen trying its way through. In this case it is already necessary to repair the leakage. This is normally done by soaking the cups which are slightly loosened by a short idle run of the compressor. For this reason, it is necessary to switch over the compressor on idle run, loosen the cups by 1 - 1 1/2 turns about of the clamp nut and let the compressor go on idle run with loosened cups for 10 - 15 minutes, in order to have the cups soaked properly through. Afterwards, with the compressor still on the idle run, the cups are to be tightened as far as possible and the

and the formation of foam, by a strong and shrill hissing of hurling out oxygen, a so called "blowing off" cannot be repaired by mere soaking of the cups on the idle run of the compressor. The "blowing off" causes a considerable loss of oxygen from the system. During the filling operation the increase of pressure in the expelling main line will be slower, which will be shown by the expelling manometer; the output of the compressor will sharply decline. In this case, it is necessary to stop the compressor, remove the cylinder from the compressor, and if work has to be carried on, to put on its place a spare cylinder, whereby the leather cups are fitted in beforehand and soaked in the glycerine-in-water solution in the way described below. The removed cylinder must be disassembled, the cups must be inspected together with the surface of the plunger pistons. The leakage may be caused by the following reasons:

a. The drying out of the leather cups at a prolongated standstill of the compressor or in consequence of an interruption in the lubrication of the plunger piston.

b. Overheating of the cylinders and consequent hardening and coarsening of the leather cups.

c. The uncorrect fitting of the leather cups with bent collars or the pressing of the inner collar outwards owing to the work of the compressor under pressure with an untightened setting nut.

d. Fissures and longitudinal flows on the plunger piston.

e. The wearing out of the cups (if they are in operation for a time surpassing the warranted service life), etc.

If the cups are in a satisfactory condition, it means in regular shape, a uniform height of collars, an undamaged surface, their shape is not conical, i.e. the inner opening is not widened to the upside and the cups are not hardened, it is possible to use them again. If

so, they are being divided into the solution of glycerine-in-water for 1 - 1 1/2 hours, in order to get them soaked in a disassembled form and they are put up in the cylinder again (see chapter "The disassembling of some main parts of the compressor in operation" Chapter VII, B). In such a case, it is not compulsory to put the cups in their former place.

Before putting up the cylinder with the inserted cups, but with the nuts not yet tightened, on its place, it has to be set for soaking - as usually for 1 1/2 - 2 hours into the solution of glycerine in water.

In this way, used leather cups may serve after their reestablishment for a number of further hours of strenuous work. In the negative case, spare leather cups are to be used. For the exchange of leather cups, there is a fixture on the right side of the body on the control panel, in which the head of the cylinder is put for disassembling. If the joints of the collectors of the compressor to the cylinder heads are not sufficiently hermetical, or if the packing of the valves is not enough hermetical, these occurences may be found out by the appearance of bubbles from below of the place of these parts, clearly visible in the water of the cooler. The threaded joints of the circulation are checked as far as their hermeticality is concerned by wettening the joints with soap water in order to produce bubbles if the oxygen leaks out.

It happens some times that during the work of the compressor, there is a whistling noticeable in the stuffing box of the driving shaft (Fig. 16, 5). This is a proof that the leather cup of the stuffing box (5) dried out and works unlubricated. To remove this deficiency, it is necessary to unscrew the flange (18) during the work of the compressor, and to spray the cups by a squirt with the glycerine-in-water solution. The leather cups will be moistened and the "whistling" will cease.

8. The work of the valves must be watched. If the work of the valves is normal, the pipes of the expelling collector should be uniformly heated, and this is possible to verify when the lid of the water cooler is removed. The irregularity of the sucking valve causes a drop in the output of the compressor, an unsteady reading on the manometer with an agitation of its arrows and an increase of the temperature of the cylinder head and of the collector pipes. Apart from that, the readings of the expelling manometer may lag behind the readings of the suckings manometer, that means that the pressure drop of the sucking branch during the repumping operation will be more quick than the pressure increase of the expelling side. This may happen as well at casual local clogging in the pipeline which are decreasing the clear section for the oxygen flow; these deficiencies are usually removed by blowing through the pipe with a pressure of at least 120 atmospheres.

If the expelling valve is irregularly set, the same occurances are experienced as in the case of an irregularity of the sucking valve with the difference that no agitation of the manometer arrow is noticeable, since the length of the expelling main line up to the manometer is considerably greater, than the sucking main line and the unstableness of the pressure will smooth down.

If it is impossible to repair the defect of the valve, it is necessary to exchange it against a spare valve.

9. Check periodically the output of the compressor. This test is to be done by a precise time measurement of the pumping over of the contents of one cylinder of 40 litres to anotherone. The test will be done in two variations:

a. At the starting pressure of 80 atmospheres in both cylinders and at a finishing pressure in the cylinders being filled of 120 atmospheres. The time for pumping over the oxygen must not be longer than 2 minutes, 24 seconds.

b. At a starting pressure of 100 atmospheres in both cylinders and at a finishing pressure in the cylinder being filled of 150 atmospheres. The time for pumping the oxygen over must not be longer than 3 minutes.

For this test those groups of cylinders are to be chosen, the manometers of which do not differ much in their readings if the pressure in both cylinders is equalized.

10. Watch the movements of the manometers' arrows and compare them to each other when the pressure in the group is mutually equalized, or with the duplicating manometer of the feeding and expelling side. Uncorrect manometers are to be exchanged for spare ones from the set of spare parts.

11. Watch the function of the safety valve by verifying from time to time the pressure of the oxygen flowing through the valve and paying attention to the hermetical closing of the valve. If the valve is not hermetical, the outletting tube to the sucking line will heat up vigorously by the oxygen flowing through.

3. The standstill of the compressor.

If a break in the compressor operation is supposed to last longer than 24 hours, then after having finished its work, it is necessary to bring the compressor to a standstill, in order to avoid trouble at a later restart. The preparation for the standstill comprises in summer as well as in winter season, supposed that the station is stored in a heated room, the following precautions:

a. If the leather cups were found during the working time in a satisfactory condition, it is recommended to release before the standstill of the compressor the pressure, loosen the leather cups and let the compressor work on an idle run for 10 - 15 minutes in order to have the cups soaked. The cups are not to be retightened, because

this will be done before the following start of the compressor.

b. Let out the cooling water from the compressor cooler.

c. Let out the gathered water in the trough through the pipe and rub the trough dry.

d. Remove the water cooler and rub it thoroughly dry.

e. Reestablish the water cooler.

4. Disassembling of some main parts of the compressor during its operation.

During the service of the compressor, it is sometimes necessary to disassemble partly some of its main parts for inspection, cleaning, blowing through, exchange for spares or a small routine repair.

When disassembling and reassembling the main parts, it is necessary to follow the instructions as given bellow:

1. The removal and reestablishment of the water cooler of the compressor:

The compressor has a removable lid, which is being taken off in order to pour water into the cooler, for probing the cylinders diameter, for the inspection and tightening of the nuts of the collector when a leakage occurs. The lid is being removed after unscrewing two handwheels, holding the lid to the body of the cooler. While the station is on move, the lid has to be in its place in order to prevent spilling of water out of the cooler.

The body of the cooler is being removed if the cylinders are being disassembled, the valves taken out and the surface rubbed clean in order to prepare the station for a longer standstill. The cooler is being removed after the unscrewing of three nuts from the studs of the cylinders.

When reestablishing the body on its place, it is necessary to verify that the bottom ring of the body is placed on the full width of the rubber washer. The body must be evenly tightened in order to secure a firm fitting of the cooler to the crankcase.

2. Disassembling and reassembling of the valves of the compressor.

The valves are taken out of the cylinder heads when the cooler has been previously removed, in the following way: The sliding nuts of the collectors are being unscrewed and are carefully bent away together with the pipes a little sidewards and downwards. A special thread spanner is being inserted into the body of the valve, and the valve is being taken out of its bush in the cylinder head. The valve is being reestablished in its place after its degreasing without the application of the thread spanner. It is necessary to pay special attention to a full lift of the valve to avoid any spoiling, to a regular fixing of the valve into its bush, and a regular inserting of the packing washers.

A thorough disassembling of the sucking valve is effected in the following order: the nuts of the valve-shanke are being unscrewed by a spanner, while preventing any movement of the valve head with the help of a screw-driver, and the valve is being taken out. The reassembling of the valve is done in the inverted order. The expelling valve is being disassembled in the following order: the locking distance-ring and then the bushing with the spring and the valve are being taken out. The valve is being reassembled in the inverted order.

3. The disassembling and reassembling of the cylinders.

The cylinders are being removed from the crankcase of the compressor and disassembled in the following way:

a. The sliding nuts of the collector are being unscrewed and bent away from the cylinder heads together with the pipes and nipples a little sidewards and down-

wards. In order to avoid hoggings and breakings, the collector is being bent sidewards while the lock nut of the shank is loosened (Fig. 8, 11).

b. The coupling nut of the leather cups is being loosened by one turn about by a special round wrench. With the help of a socket wrench the nuts, which are holding the flange of the cylinders to the crankcase are being unscrewed and the cylinder is being taken out of its bung hole in the crankcase. If it is impossible to take the cylinder out of its bung hole by hand, a special clamp is to be set up and the cylinder is to be pulled out with the help of a nut, screwed on through the clamp on the stud of the cylinder head.

c. The leather cups are being disassembled, when the coupling nut has been completely unscrewed, and with the help of a special device all packing rings are taken out together with the cups.

The special device is used in the following way (Fig. 33): the sliding nut is being unscrewed (1) as far as the bottom ring of the handle (2) allows and a clamp is being inserted as far as possible into the cylinder. The handle (3) is turned round, the ends of the clamp opened and they are gripping the bottom of the packing ring (4). Afterwards the whole assembly of the cups is taken out, while the nut (1) is being turned round and the handle (2) held by hand.

The reassembling of the cups after the degreasing of all its parts is done with the help of a special device (Fig. 34), consisting of a guiding bushing and an arbor. In order to reestablish the leather cups assembly, the necessary number of spare cups is taken and successively, always for each cylinder a few pieces at a time, are being dipped for 2 - 3 minutes into the glycerine-in-water solution. Afterwards one of the cups is taken out, immersed into glycerine, and put on the end of the pusher and is driven into the bushing up to the edge. Care must be taken that the edge of the exterior collar

is not twisted and corresponds with the upper edge of the bushing (Fig. 34). The cylinder is being mounted into a clamp on the frame of the control panel with its opening upwards. The upper brass packing ring (Fig. 13, 9) soaked in glycerine, is lowered and the first leather cup is inserted into the cylinder through the special device (Fig. 36). In a simple way, also the remaining two cups are inserted into the cylinder.

In order to facilitate the mounting of the cylinder, the cylinder is being fastened into the device by a clamp which is screwed into the protruding end of the stud (Fig. 36).

When cups made of special thick leather or cups swelled during the soaking are being inserted into the cylinder, it is necessary to strike firmly on the shank of the handle of the pusher in order that the cups reach their place, otherwise the whole assembly of cups could not be tightened by the coupling nut.

Further the distance ring (Fig. 13, 11) is being inserted and the coupling nut (Fig. 13, 12) of the cups is tightened with the help of a ring spanner.

For a closer tightening of the cups it is permitted to use an extension of the spanner (a flattened pipe, 180 m/m long).

If some cups in the glycerine-in-water solution start to swell quickly, it is necessary to insert them into the cylinder with priority, not allowing them to swell too much, otherwise it will be utterly impossible to insert them into the bushing.

Spread cups may not be inserted and are of no further use. Before the cylinders are mounted on the compressor, they are dipped together with their cups - so far unfastened, i.e. with loosened coupling nuts, for 1 1/2 - 2 hours into the glycerine-in-water solution in order to get the cups soaked.

Before the cylinders are mounted on the compressor,

the coupling nuts are tightened as much as possible and the cups are to be spread around the diameter of the plunger piston, in order to set the cylinders more easily on the plunger pistons. For this purpose a tapered arbor (No 28-233) is being used, which is added to the spares set, and which sould be lubricated with glycerine preliminaliry, and inserted into the cylinder by helical turning.

When the cylinders are being mounted, it is necessary to watch that the mark on the cylinder corresponds to the mark on the bung hole of the crankcase.

4. The cleaning of the injectors.

The nozzle pipes of the injectors are first of all cleaned without their disassembling with the help of a special needle.

If the pipes cannot be cleaned in this way, it is necessary to unscrew the threaded plugs, i.e. the screws on the ends of the pipes and to blow the pipes through.

5. The disassembling and reassembling of the pump.

The body of the pump is disassembled without the removal of the compressor in the following way:

a. The impulse sender of the electrotachometer is disengaged from its socket on the lid of the pump.

b. The lid of the pump is removed after the unscrewing of five nuts on the studs.

c. The locking washer and the shank of the crankshaft are unscrewed with the help of a special short socket wrench and the bolt, the locking washer, the gears, the dowel and the first regulation ring are being removed.

It is necessary to remember the place of the removed regulation rings as their interchangement is not permitted.

If the body of the pump fits closely to the crankcase and if it is not possible to remove it by hand, it is necessary to lever it off with a screwdriver which is inserted into the side grooves on the body with slight

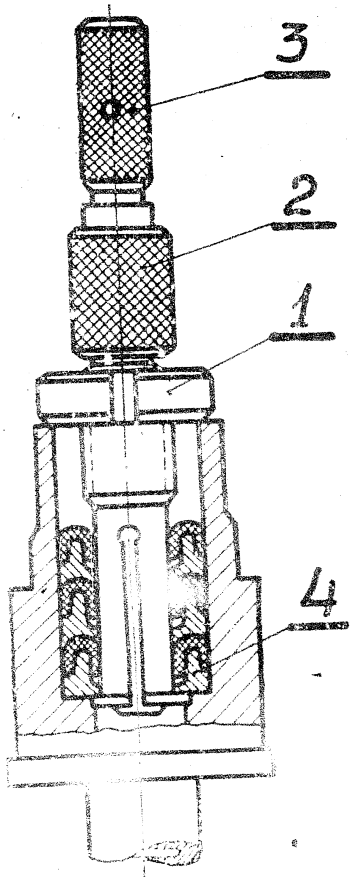

Fig. 33. Device for taking out the leather cups of the cylinder.

1. Distance ring
2. Handle
3. Handle
4. Packing ring

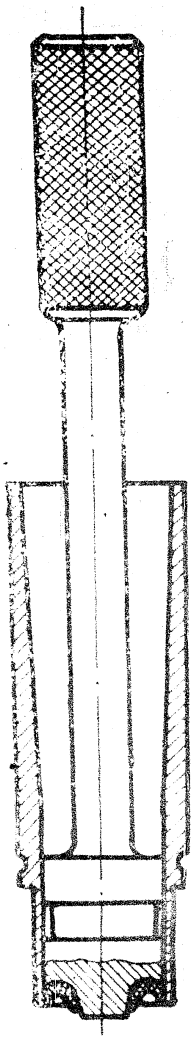

Fig. 34. Fixture for the inserting of the leather cups: the cup is put into the sleeve of the fixture - this is the first stage of the insertion of the cup into the cylinder.

strokes of the hand. Care must be taken not to damage the washer.

The channels of the pump are being rinsed through the openings being in operation, closed by nipples and plugs.

The assembling of the pump is being done in the inverted order.

During the work, a tightening or an exchange of the stuffing boxes of the rotors of the pump may be necessary. For this purpose a full disassembling of the pump is not required. It is only necessary to remove the cast iron lid of the pump, to disengage the impulse sender of the tachometer, to unscrew and remove the driven gears of the pump, and after this is done, to tighten the nuts of the stuffing boxes or to perform the required exchange.

The leakage through the stuffing box of the water-glycerine pump may be the cause of spilling of the glycerine-in-water solution into the crankcase, the lubricant oozing

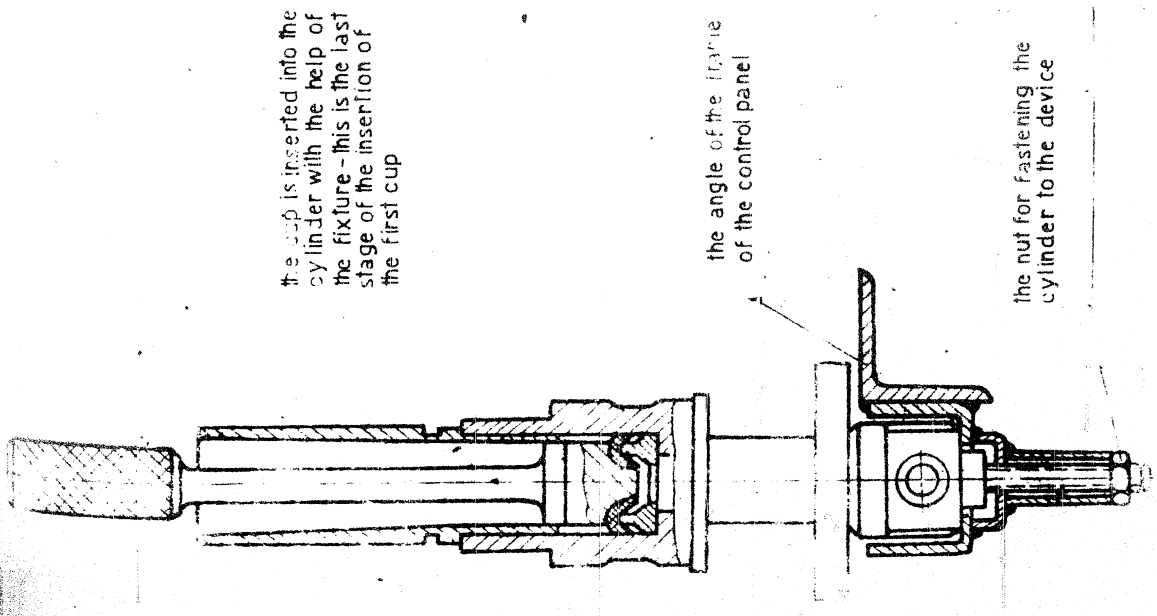

Fig. 35. Arbor for the inserting of the leather cups.

through the stuffing boxes of the pump and penetrating into the crankcase because of insufficient tightening of the body of the pump. This state of things may be shown by an excessive decrease of the glycerine-in-water solution quantity in the chamber, while the supply of glycerine in the crankcase is simultaneously increasing.

One of the reasons of the running of the solution of glycerine in water from the crankcase may be a leakage from below the brass lid of the glycerine-in-water solution pump in consequence of tightness disturbing. This lid is closely fitted to the body and apart of this, it may be packed with a chirurgical silk thread.

The thread must be soaked in glycerine and carefully twisted into two streams - on the edge of the cavity and on the outer outline, but it must not cover the openings for the bolts.

The lid and the motor must be set accurately without damaging the thread.

Sometimes, it is necessary to open and clean the ball of the safety valve of the pump (Fig. 9, 32), since if the valve is chocked up, the pump will let the lubricant rought to itself, but it will not press it into the lubrication pressure line. The cleaning and blowing through of those valves is done after unscrewing the plugs and regulating screws, not disassembling the whole pump.

6. The disassembling and regulation of the safety valve of the compressor (Fig. 36).

The safety valve is regulated and sealed by the manufacturer, so that it is not recommended to remove and disassemble it unless absolutely necessary. During the work of the compressor, however, failures of the safety valve for any reason are possible. So for instance: the chocking up of the valve, the wearing out or the crumbling out of the ebonite cushion (11 - 05) may lead to an untight fitting of the cushion to the valve seat (11 - 02) and consequently to a smaller or considerable leakage of oxygen into the sucking main line. This may be shown by

a strong warming up of the outletting pipe of the safety valve. The untightness or damage of the diaphragm (11 - 10) enables the leakage of oxygen through the checking opening of the cap of the valve (11 - 15). An uncorrect regulation of the spring or a strong chocking up of the filter may be the reason for a higher pressure of the by-pass valve.

The safety valve is being disassembled in the following order (Fig. 35):

a. Unscrew the sliding nuts of the expelling and sucking main lines.

b. Unscrew the lock nut (11 - 16) and unscrew the cap of the valve (11 - 15) having removed the seal.

c. Take out the spring (11 - 14) with the upper (11 - 12) and lower (11 - 11) washer.

d. Unscrew the clamp (11 - 13) carefully take out the diaphragm and the valve with the cushion and regulating screw.

e. If necessary, unscrew the body of the filter (11 - 06) or the seat of the valve (11 - 02), remove the body of the valve (11 - 01) of the crankcase of the compressor.

The reassembling is done after the removal of deficiencies and degreasing in the inverted order, the degreasing is being done according to the instructions; for degreasing it is recommended to degrease the valve with the pressed in ebonite cushion with high-octane petrol of the brand "GALOSH ".

The regulation of the valve is done by a gradual turning of the cap of the valve (11 - 15) which is squeezing the spring. The cap is turned when the valve is not under pressure. After each turn a pressure test is to be done. As the cap is tightened, the starting pressure of the passage of oxygen through the valve is increased.

As soon as the required pressure of the passage of oxygen (165 - 175 atmospheres) is attained, the cap of the valve is fixed by the lock nut (11 - 16) and the safety valve is finally tested according to the method, indicated

in the Chapter "Test of the safety valve" (Section VII, B). While doing so the sucking pressure has to be regulated within the limits of 70 - 110 atmospheres.

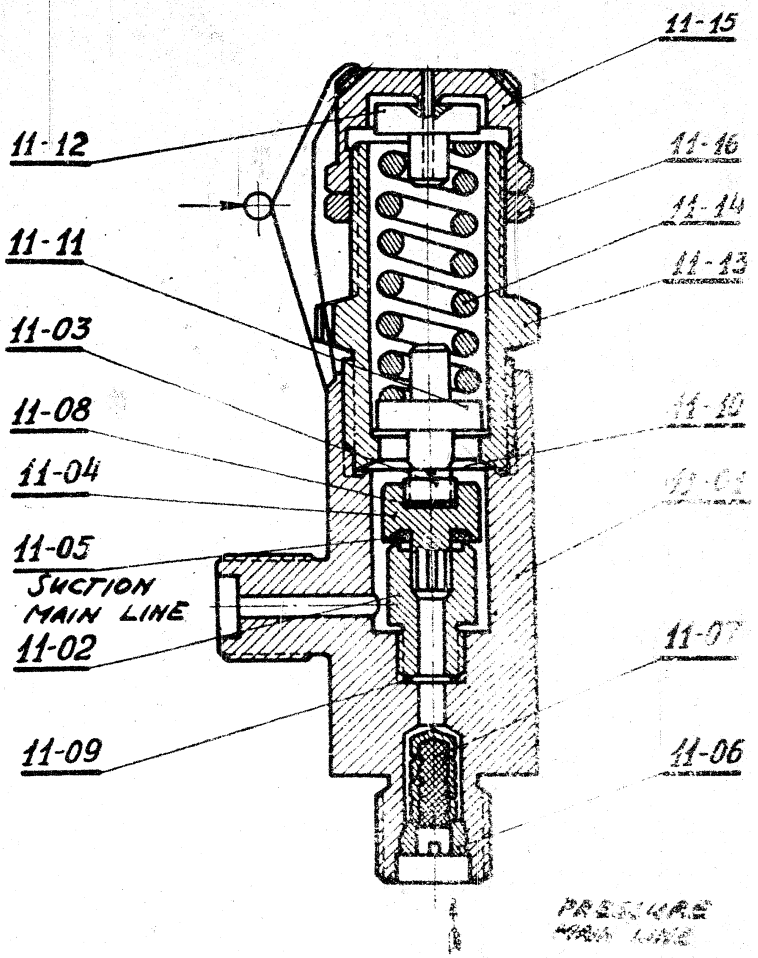

Figure 36. The safety valve.

11-01	Body.	11-09	Washer
11-02	Valve seat	11-10	Diaphragm
11-03	Regulating screw	11-11	Lower washer
11-04	Bushing	11-12	Upper washer
11-05	Cushion of the valve	11-13	Clamp
11-06	Body of the filter	11-14	Spring
11-07	Filter screen	11-15	Cap of the valve
11-08	Regulating washer	11-16	Lock nut

7. Removal of the compressor from its place.

It is necessary to remove the compressor from its place in the case when a routine repair or the exchange of some parts (connecting rods, bearings) is required or if glycerine is leaking through from under the bottom. Before the removal of the compressor all pipelines are to be disengaged, the impulse sender of the tachometer is to be removed, the drive is to be disengaged (in order to disengage the drive from the compressor, the cast-iron cooler with its wall is unscrewed from the side of the compressor, and the flange of the removable hinge is being unscrewed). Afterwards, the nuts of the bolts, which fix the compressor to the frame, are unscrewed. When the compressor is removed, the water has to be poured out of the cooler, the glycerine out of the crankcase and the glycerine-in-water solution out of the chamber.

8. Disassembling of the clutch.

The disassembling of the elastic clutch is being done while the compressor is removed, when it is necessary to inspect the condition of the rubber bushings on the fingers of the clutch or of the fastening dowel. If the station works for a long time, the bushings may wear out, and clearances may appear at their junctions with the bung holes. In this case the possibility of contact of the walls of the openings with the metal washer cannot be excluded. This may be a cause for knocks while the compressor is working. In order to disassemble the clutch, six nuts are unscrewed, which are holding the cast-iron lid of the clutch (41, Fig. 8) to the crankcase. The lid is being removed together with the shaft, fixed on it and with the driving disc of the elastic clutch, simultaneously from all the six pins, and the driven disc of the clutch remains with its pins on the crankshaft. The clutch is also simultaneously put on all the pins.

The exchange of the stuffing box of the drive shaft is performed without demounting the compressor. To do so, the flanges of the universal joints are removed (after

the removal of the cast-iron cooler from the wall of the body), the head of the rear cardan shaft is let downwards, and the splined flange is taken off the shaft. Afterwards the pressing flange (Fig. 16, 18) is unscrewed, and the distance ring (17) as well as the thrust sleeve (6) with the leather stuffing box are taken out.

9. The disassembling of the dehumidifier (Fig. 20).

The disassembling of the dehumidifier and the removal from its place is being performed especially when the SILICA GEL is being changed. The disassembling takes place when there is no pressure in the circulation, in the following order:

a. The socket of the pipe of the ceramic filter on the upper neck of the dehumidifier is being unscrewed with the wrench "32". The socket on the bottom of the ceramic filter is also being loosened. The pipe is being bent sidewards.

b. The socket of the pipe of the moisture separator on the lower mouth of the dehumidifier is being unscrewed with the wrench "32". The pipe is being bent sidewards.

c. The sliding nut of the outlet pipe is being unscrewed with the wrench "27" from the valve for blowing through the dehumidifier.

d. The upper (outlet) socket of the dehumidifier is loosened with the wrench "36".

e. The bolts on the collars, holding the dehumidifier to the frame of the control panel are being unscrewed with the wrench "17", the dehumidifier is being taken out upwards. Doing so, care must be taken that the dehumidifier does not slide downwards, and does not damage the outletting valve - the weight of the dehumidifier, charged with SILICA GEL is approximately 25 kg.

f. The loosened outlet socket of the dehumidifier is unscrewed by hand. The Silica Gel is strewn out of the dehumidifier into a clean vessel (for subsequent reconditioning). It is recommended to tap on the cylinder,

while strewing the Silica gel out, in order that the Silica gel shoots out freely and does not get stuck on the walls.

The reassembling and reestablishment of the dehumidifier is being performed in the inverted order. When filling the dehumidifier with Silica gel, it is recommended to use a funnel rolled of clean paper or of a degreased tin-plate.

10. The disassembling of the ceramic filter.

The disassembling of the ceramic filter is done when the ceramic barrel is exchanged, when the filter does not fit tightly to the body and in other exceptional cases. The disassembling may be performed in a maintenance workshop after the filter has been removed from its place. To do so, the pipes of the oxygen circulation are to be disengaged from the filter and the collar and the three bolts, which fasten the body to the wall bracket, are being unscrewed. The unscrewing of the plug as well as the tightening of the washer of the body may be done by strong pressing with special box spanner with a diameter of approximately 55 m/m. An extension is used with this spanner. As an extension any pipe of the length of not less than one meter may be used.

When screwing in the plug, it is recommended to soak the washer with the solution of glycerine in water in order to decrease the friction in the washer. This will also make the tightening easier.

D. The work of the drive and the switching in of the compressor.

During the work of the compressor, it is necessary to watch that the power distributing gear box and the reducing gear work rhytmically without strange noises and without overheating. The temperature is being controlled by touching, and the temperature must not exceed 60 - 70°

Centigrade. In the case of an excessive rise of temperature of the reducing gear and of the power distribution gear box, the work of the station has to be stopped for their cooling down. The supply of lubricant in the body of the reducing gear must be controlled, as well as in the casings of the universal joints. The space of the power distributing box is filled with lubricant from the transmission gear box through an opening of the joining flange, therefore it is necessary to pour the lubricant directly into the compound box. A mixture of 50% AVTOL "10" (truck oil) and 50% SOLIDOL "L" (grease lubricant) is being poured into the reducing gear. The use of tractor oil of the "NIGHOL" brand is permitted. The lubricant is being poured through a plug on the righthand side of the reducing gear up to the level of the plug. The capacity of the oil-reservoir is 1,5 kilograms. After every 20 - 25 hours of work of the reducing gear the lubricant supply is to be completed. The exchange of the lubricant is being performed in the following periods: in new engines after every 20 - 25 hours of work during the first 100 hours; further on, the lubricant is changed after every 100 hours of work. While changing the lubricant it is necessary to wash through the body of the reducing gear with parafin oil.

The universal joints are lubricated with grease lubricant "SOLIDOL" by means of a truck grease gun through special lubricators on the joints. The supply of grease is completed every 20 working hours of the drive.

1. Starting of the compressor.

In order to start the compressor, it is necessary:

a. To start the truck motor, with the lever of the truck gear box in the neutral position.

b. To push down the pedal of the clutch.

c. To switch in the lever of the power distribution box by pulling it in the direction towards yourself.

d. To leave smoothly the clutch pedal.

In order to switch the compressor out, it is necessary to disengage the clutch pedal, to push the handle of the lever for switching in the compressor in the direction from yourself, and to let the pedal loose. The switching in and the switching out of the compressor may be only done from the driver's cabin as soon as the respective signal was given from the compressor compartment (the green lamp means to clutch in the compressor, the red lamp - stop the compressor). Only in cases of emergency it is possible to stop the compressor by pressing down the push button "Stop the motor" on the control panel.

2. The disassembling of the main parts of the drive.

A full or partial disassembling may be found necessary at the appearance of any deficiency in the drive, e.g. strange knocks, vibration and strikes of the shafts, overheating of the body of the reducing gear or of the power distrubuting box, unremovable leakage of lubricant etc.

3. Removal of the front cardan shaft.

The removal of the front cardan shaft is performed in the following order:

a. Four bolts of the flange of the collar (on the side of the power distributing box) are being unscrewed.

b. The flexible shaft is shifted forwards and downwards, and is being taken out of the split fork of the universal joint, which is fastened to the shaft of the reducing gear.

4. Removal of the rear cardan shaft:

The removal of the rear cardan shaft is being performed in the following order:

a. The cast-iron cooler with its wall is being unscrewed from the side of the compressor.

b. Six bolts of the flange of the removable joint (on the shaft of the compressor) are being unscrewed from the compressor compartment of the body.

c. The rear end of the shaft with the joint are being lowered into the oval cut out in the body wall.

d. The shank bolt on the shaft of the compressor is being unscrewed and the flange taken off.

e. The rear end of the shaft is being supported and is shifted towards the compressor until the front end of the shaft gets out of the splits of the universal joint on the reducing gear.

f. The front end is being lowered down, and the shaft taken out of the engine from below.

5. The disassembling of the universal joints.

The disassembling of the universal joints is being done in the following order:

a. The covering of the universal joints, made of waterproof fabric, are being unscrewed and shifted away.

b. The casing of the joints is being disassembled.

c. The shank bolt of the joints is being unscrewed and the fork of the joints is being hauled down from the splits of the shaft.

6. The assembling of the shaft.

The assembling of the shaft is being done in the inverted order. It is, however, to be borne in mind, that the forks on the universal joints have to be placed both in one level.

To secure a regular position of the forks, it is necessary that the special marks, engraved on the casings and the forks of the joints, coincide. In order to be able to follow these marks, it is recommended to remove the waterproof fabric covering the joints before assembling the shaft, to put them on the shaft and after having set up the shaft, to fasten it on the flange of the casing of the joint.

7. The removal of the reducing gear of the drive.

In order to remove the reducing gear, it is necessary to disengage the front cardan shaft and to unscrew four bolts, which hold fast the reducing gear to the wall

bracket. It is necessary to disengage the rear cardan shaft while removing the reducing gear, since the front end of the shaft freely leaves the splines of the fork of the universal joint.

E. Routine work.

When using the station, strict rules - as given below - are to be followed.

a. Compressor.

1. The lubrication with glycerine.

The main necks and the necks of the connecting rods of the crankshafts and of the crosshead, the upper heads of the connecting rods and the ball bearings of the splined shaft are lubricated with glycerine.

The mark of the glycerine to be used is dynamite or distilled glycerine with an anticorrosive addition, consisting of 2% potassium chromate ($K_2 Cr O_4$) and 0,13% sodium hydroxide (NaOH) of the weight of the glycerine. The quantity of the poured glycerine is 5,3 litres. The level of the poured in glycerine has to be between the checking marks of the inspection window of the crankcase. The filling is done through an opening covered by a plug 26 (Fig. 9).

During the work of the station, the glycerine in the crankcase is getting wet, it is therefore recommended to pour out the glycerine after 75 working hours and to change it by new glycerine.

NOTE:

The poured out glycerine may be used for the preparation of the glycerine-in-water solution, having passed it through a filter and ascertained the percentage of moisture.

2. The lubrication with the glycerine-in-water solution:

The leather cups, the plunger pistons and the stuffing box of the driving shaft are being lubricated with the

solution of glycerine-in-water. This solution consists of 20% of glycerine diluted in distilled water. The solution is filled in through an opening covered by a plug 37 (Fig. 9) of the glycerine-in-water solution chamber on the righthand side of the crankcase up to the level of the plug. The capacity of this chamber is 1,25 litres. The refilling of this solution depends on the leakage and evaporation (at normal work it is necessary to add not more than 250 grammes after a four hours work of the compressor).

After 50 - 70 hours of work it is necessary to wash through the chambers and the filter with water and for this reason the filter 28 and the plugs 35 (Fig. 9) on the front wall of the compressor are being unscrewed.

The stuffing box of the driving shaft is refilled if some kind of "whistling" occurs, in consequence of the drying out of the stuffing box. In order to do so, it is necessary to unscrew the flange and squeeze on it with a syringe a streak of the solution of glycerine in water.

b. Drive.

Mixture of 50% of truck oil AVTOL brand "10" and 50% of grease lubricant SOLIDOL brand "L".

With this mixture the gears of the reducing gear are lubricated. The weight of the filled lubricant is 1,5 kilos. The filling is done through the filling socket on the righthand side of the reducing gear. The lubricant is to be refilled after 20 - 25 working hours.

During the first 100 hours of work, the lubricant is being exchanged after every 20 - 25 hours; further on, only after every 100 hours of work of the reducing gear. While changing the lubricant, the body of the reducing gear is being washed through with paraffin oil. The use of tractor oil of the NIGHOL brand is permitted.

2. Grease lubricant SOLIDOL.

Four points are to be lubricated with this lubricant.

The lubrication is done by a grease gun through an especially designed lubricator. The quantity of the grease charged in is 0,25 kilos per lubricated point. The lubricant is being refilled after each 20 hours of work of the drive.

NOTE:

The inner space of the power distributing box is connected with the gear box of the truck through the opening in the flange, and when filling the gear box with lubricant, the power distributing box is also being filled. It is therefore not necessary to pour the lubricant into the power distributing box.

The filling of the gear box with lubricant is being done in accordance with the instructions for using the truck through a special funnel, which is to be found among the equipment, and which is being kept below the driver's seat.

b. Oxygen pipeline.

1. Special lubricant on the basis of glycerine.

With this lubricant the threads of the arbors on the valves of the control panel are lubricated, in order to smoothen the rotation of the arbors. For lubrication it is necessary to unscrew the head out of the body, then unscrew the arbor out of its nut, to put 2 - 3 drops of lubricant on the thread and turn several times the arbor in the nut, in order to spread the lubricant evenly on the surface of the thread. Afterwards, put the head of the valve on its place. It is necessary to lubricate the thread of the arbor after 50 working hours of the station. It is strictly forbidden to use any other kind of lubricant, except of the one supplied for this purpose in the equipment of the station. Below are indicated the characteristics and the technology of its production.

Physical and chemical characteristics of he oxygen proof lubricant on the basis of polyglycerine and glycerephtalate resin:

1. Specific weight at a temperature of 20° Centigrade 1,2857.
2. Colour: light cinnamon.
3. The lubricant is transparent.
4. The lubricant is soluble in alcohol, benzol, acetone and water.
5. Relative viscosity of the 10% solution in alcohol at a temperature of 20° Centigrade is 1,3.
6. Acid value 1,7.
7. Saponification number 122.
8. The lubricant is stable at a temperature of 20° Centigrade.

The technology of the production of the oxygen-proof lubricant:

100 parts of glycerine by weight and 14 parts of phtalic anhydrite are being heated and stirred in an aluminium or cast-iron enameled kettle for six hours, at a temperature of 240° Centigrade and for the same time at a temperature of 250° - 255° Centigrade. During this procedure, approximately 20 weight parts of the water distilate with a disagreable smell are driven away. The distilate gets condensed with the help of a direct condenser and is being collected into a receiver.

During the reaction, the production of aorolain must be watched and it is necessary to keep this compound out of the sphere of reaction by having it absorbed by ammonia or another absorber. During the reaction, the perceptible rise of the viscosity of the solution under reaction as well as the changing of its colour into light cinnamon is to be watched.

The acidity value drops to 2 - 3, which together with the change of the viscosity may serve as a method for the checking of the regular course of the reaction. After the lapse of the above mentioned time, the reaction is to be broken up. The cooled down transparent lubricant is to be poured into a collector, it is to be analyzed and used according to instructions. The output of the

lubricant equals to 86 - 92% of the weight of the glycerine. In order to get a neutral lubricant, a small quantity of urea (acidity value 0,3 - 0,5) is to be added.

The filling with water.

The water cooler of the compressor.

The capacity of the water cooler of the compressor is 5,5 litres. The filling is being done while the lid of the cooler is removed. Should the temperature of the water exceed 50° Centigrade, it is recommended to pour out the water and exchange it against fresh water. The water is being let out into a bucket through a cook on the lefthand side of the cooler.

1. The refilling of the dehumidifier.

The refilling of the dehumidifier is being done after 25 working hours of the compressor. The dehumidifier is being filled with Silica gel of the mark "KSM". The capacity of the dehumidifier is 3,8 litres. Two jars of Silica gel are provided for each station and each jar contains one refill of the dehumidifier. The Silica gel jars are fitted with a hermetical sealing and contain Silica gel of the standard quality, with which the dehumidifier may be filled right away. The employed Silica gel may be reconditioned and used again for filling the dehumidifier. The Silica gel is being reconditioned on a clean and degreased zinc coated sheet iron. The layer of Silica gel must not exceed 2 Centimeters. The reconditioning is to be done for four hours at a temperature of 180 - 200 Centigrade in a dessicator with a hooded drying oven, on a charcoal or an electric heater etc. It is necessary to care that the Silica gel does not get in contact with smoke and does not get soiled by caustic substances. After the reconditioning, it is recommended to sift the Silica gel through a screen sieve with a mash width of 2,5 - 3 m/m. The reconditioned Silica gel is to be filled immediately into the dehumidifier or strewn into jars with a hermetical sealing in order to prevent its moistening on the open air.

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2. The blowing through of the ceramic filter.

In the run of time, the outside surface of the ceramic filter may get clogged up by Silica gel particles, in consequence of which the passing of oxygen through the filter is rendered more difficult and the whole resistance in the circulation of oxygen is increased. In order to remove this chocking up, it is necessary to blow the filter through periodically by an inverse oxygen flow.

This blowing through is done with the compressor stopped, without disassembling the filter, but with the inlet pipe disengaged in the following order:

1. Close all valves of the control panel.
2. Open the valve of the cylinder of any group whichever.
3. Unscrew the sliding nut on the socket of the dehumidifier and bend the entry pipe of the ceramic filter a little sidewards.
4. Open slowly the expelling (upper) valve of the group to which the opened cylinder belongs.

With this arrangement the oxygen will flow out from the cylinder through the expelling line and through the ceramic filter in the inverse direction. The pores of the ceramic filter will get cleaned by the flow of oxygen.

The blowing is to be done for 20 - 30 seconds, afterwards close the valves and connect again the entry pipe to the dehumidifier.

Although the pressure has no influence on the blowing through, it is recommended to perform the blowing through a low pressure of 30 - 50 atmospheres.

It is necessary to blow the filter through after 50 - 60 working hours of the compressor.

The checking of the condition and the cleaning of the filter.

1. The oxygen filter on the sucking main line.

After every 50 working hours of the station, it is

necessary to clean the filter and to blow it through, for this purpose it is necessary to unscrew the sliding nut of the shank of the sucking collector, to bend away the socket and to take out the filter of its bung hole in the shank (Fig. 8, 11). After the cleaning and blowing through, degrease the filter, put it on its place and tighten the sliding nut of the shank.

2. The oxygen filter on the inlet socket of the safety valve.

The checking, cleaning and blowing through of this filter is to be done after every 50 working hours of the station, and in order to do so, the valve is to be unscrewed with the help of screwdriver out of its bung hole on the expelling socket of the valve. Before being put back on its place, the filter has to be degreased.

3. The filter for the solution of glycerine in water on the sucking line of the pump for this solution.

This filter is connected to the sucking socket, which is screwed into the hatch of the front wall of the crankcase. In order to blow it through, it is necessary unscrew the filter, having beforehand unscrewed the nipple and disengaged the sucking pipe.

The filter is to be washed through with distilled water after 50 - 70 working hours of the station.

The glycerine filter (30, Fig. 9).

The filter is fixed on the sucking line of the glycerine pump (within the body of the pump). In order to take the filter out, it is necessary to disengage the impulse sender of the tachometer, remove the cast-iron lid of the pump and the driving gear of the pump, to loosen the wire lock of the two screws, fastening the body of the filter, and to unscrew the screws mentioned above. The filter is to be washed through with clean distilled water.

The checking and washing through of the filter is to

be done not later than after 50 - 70 working hours of the compressor.

The exchange and reestablishment of leather cups.

The exchange of the cups is to be performed when they are causing an irreparable leakage of oxygen in consequence of their wearing out (having worked for a longer period than warranted, i.e. more than 50 hours), in consequence of their irregular fixing into the cylinder or of unsufficient greasing or overheating of the compressor.

NOTE:

1. The order of taking the leather cups out of the cylinder and their fixing in their place is thoroughly described in Chapter VII, C of this booklet.

2. When putting the cylinder on its place, it is necessary to check properly the plunger piston as far as the cleanliness of its working surface is concerned, as well as the absence of scratches, scars, notches etc., which may cause an irreparable leakage of oxygen.

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